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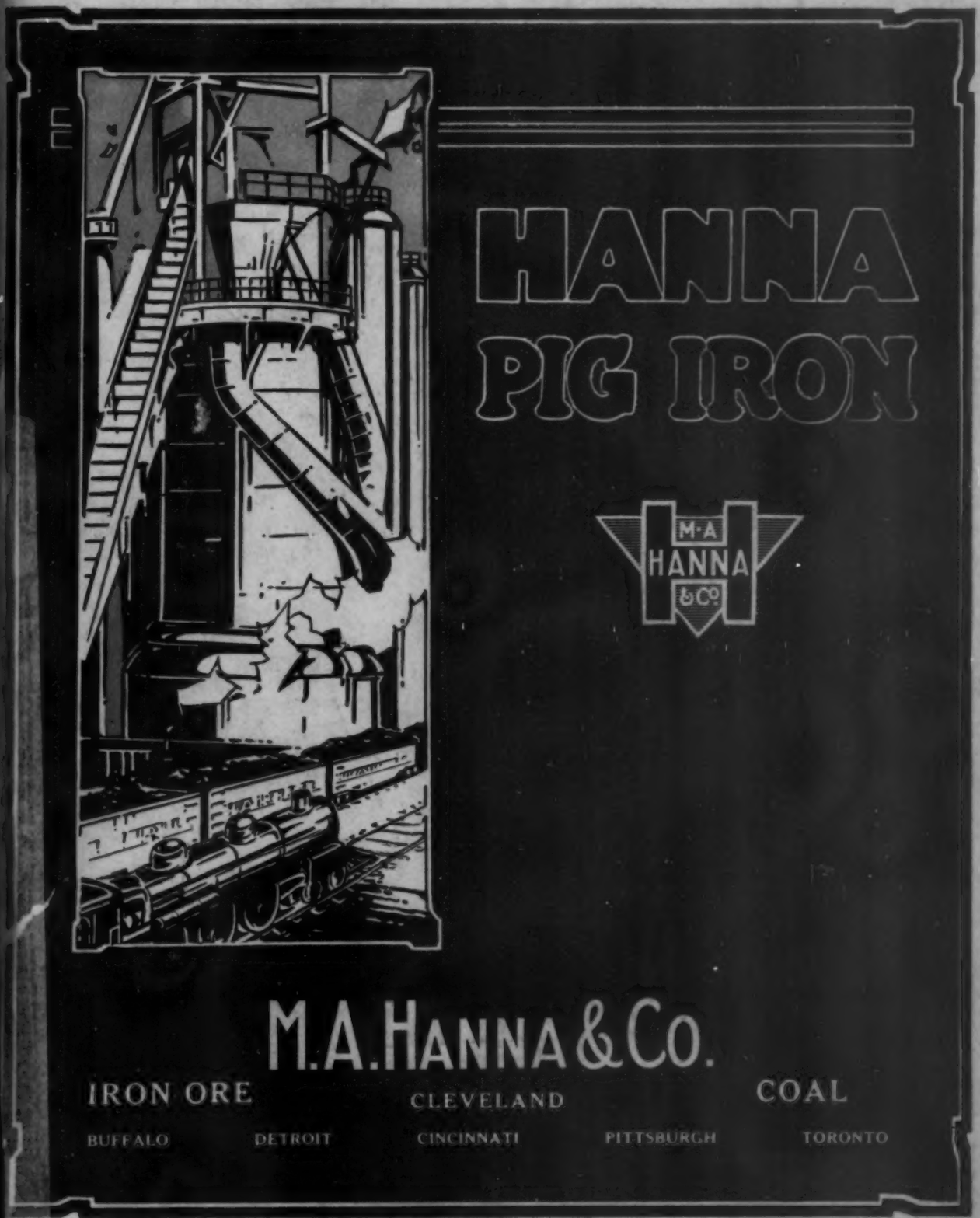

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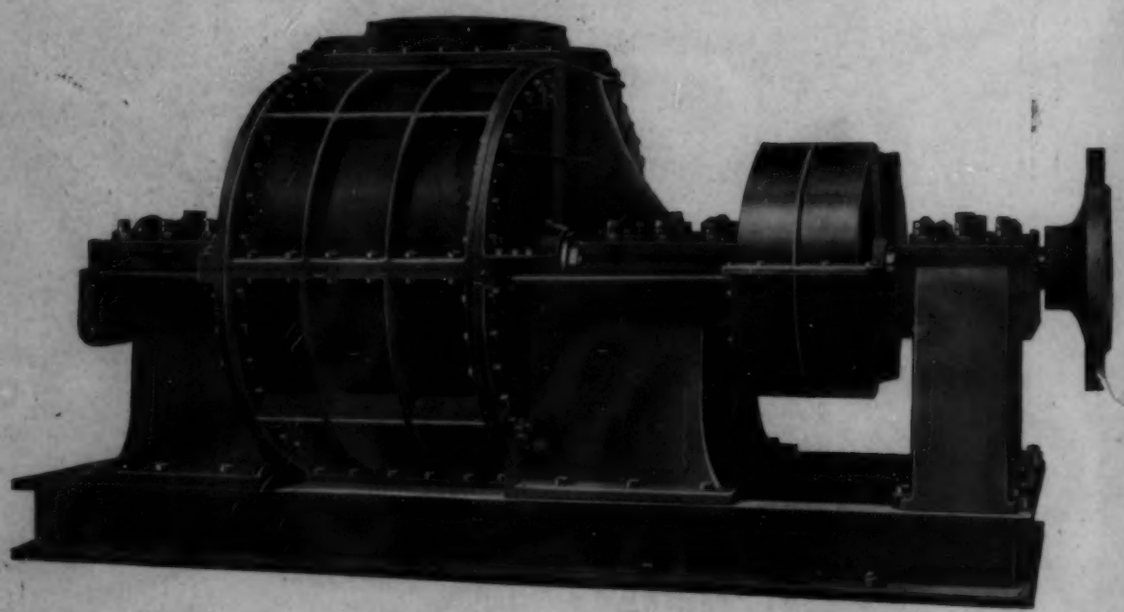

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THE IRON TRADE REVIEW

Vol. LXVIII Cleveland, January 6, 1921 *No. 1*

National Sanity Is Returning

BY C. J. STARK

ONE OF the greatest years in gross volume of business done, perhaps the greatest in the commercial history of the United States has just been passed. Large profits have been returned in many lines. A tremendous expansion of productive capacity has been paid for out of earnings. Individual incomes for a great number measured by dollars have been raised to an unprecedented degree. But in the final summing up of accounts, has it been a satisfactory year in the real sense? Truth and sober judgment compel a negative answer.

In a business way, a large part of the year has been a time of feverish and unrestrained activities based upon fictitious standards of demand and of prosperity. As a period of commercial development it has lacked that rational and provident quality that makes for sound and lasting progress. Savings and thrift have not been proportionate to income. Waste and extravagance have been prevalent. Luxuries have absorbed both capital and labor in undue amount. Thought and action have been dominated wholly by the extremes of things and moderation or conservatism has been out of fashion.

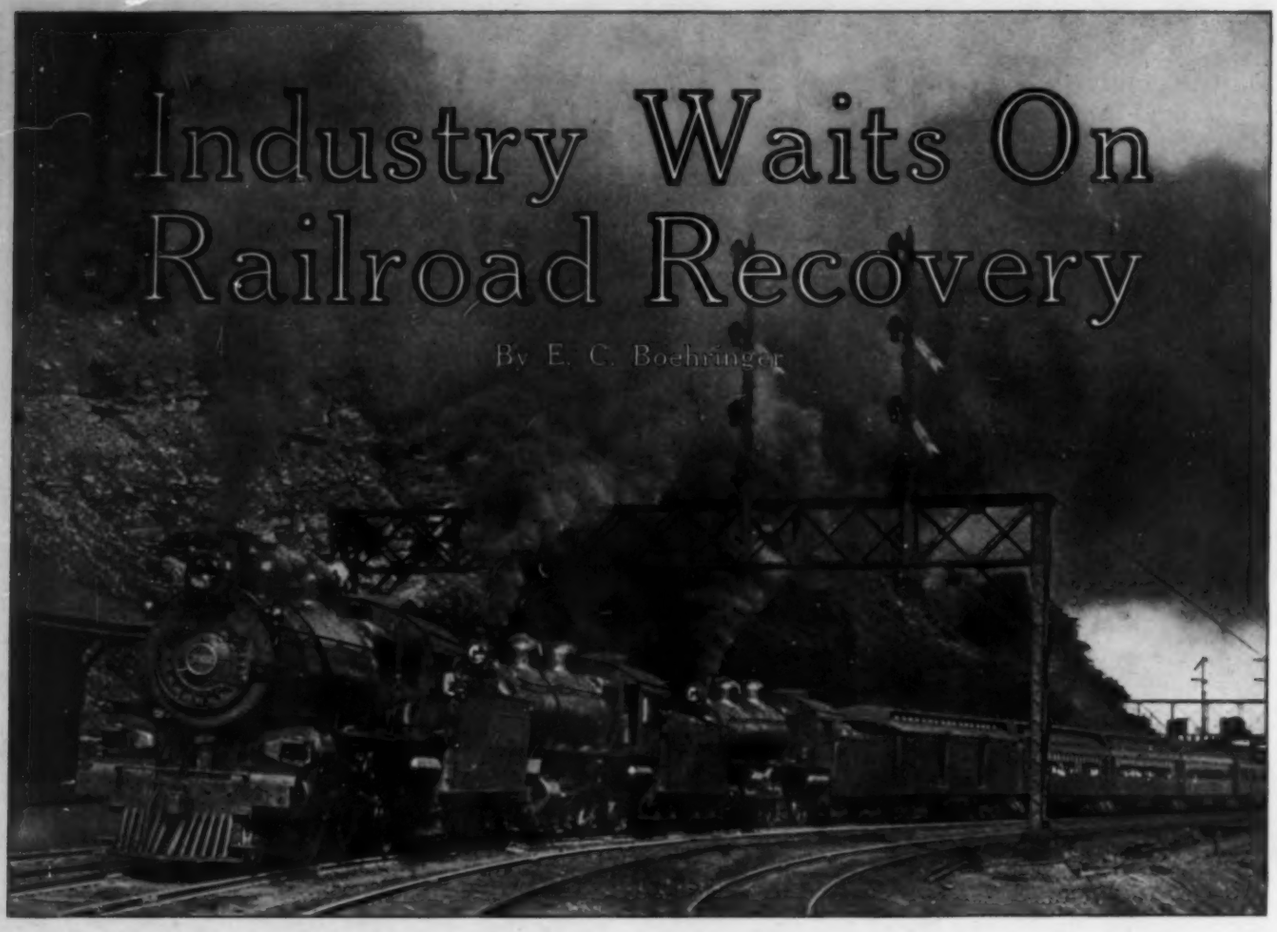
It is highly probable that what has been witnessed in American life the past year represents a logical reaction following the abrupt lifting of the restraints imposed by the greatest war since civilization began, with its far-reaching effects upon every individual. Certainly a similar phenomenon has made its appearance in all leading countries, from which some are emerging with greater rapidity than others.

What now has happened has been inevitable. A false structure of values built to a fantastic height in an orgy of reckless spending and inflation is collapsing. The pendulum having swung so high is swiftly reversing its course. The forces of readjustment and deflation are holding irresistible sway. That they will continue to dominate every branch of business endeavor until the process is complete and stability is restored is certain. At the moment, it is impossible to detect or to predict at what point equilibrium will be reached.

What does all this mean to American business life? It signifies that old and proved standards must replace the hectic and fanciful basis of the recent past. An entire revision of production costs is essential if prices are to be brought within the limits of reduced purchasing power and the available supply of liquid credit. In the thoroughness with which this revaluation of productive factors is carried out will the flow of trade be controlled. Competition of costs and of efficiency must return to supersede competition of mere speed of output. In the end prices will be determined by the only factor that is really influential, and that is general purchasing power which will regulate the demand for goods.

At the dawn of 1921, the picture is anything but gloomy for American business. Fundamental conditions in the United States never were sounder, worldwide shortages of essential commodities created by war conditions remain unsatisfied and the needs of a great and growing population are accumulating. The rewards of initiative, of energy and of good management are fully as alluring as in the past. It is a time not for pessimism but for encouragement; a time for satisfaction that economic justice is working out its ends in its own way and that national sanity is returning. Under such conditions business and enterprise may go forward with renewed confidence in a truly American way and the commercial future of the nation will be safeguarded.

W.T.S.



Industry Waits On Railroad Recovery

By E. C. Boehringer

WALL street, so the belief runs, discounts the immediate future and thus usually is one lap ahead of the shorter-sighted public. In much the same category falls the railroad executive. The turn of the New Year does not find him bemoaning the slump in business; that is water over the dam. Rather, it reveals him striving to ascertain just when the upturn will come and with what speed it will make the grade. In the South he sees the major portion of the 1920 cotton crop and much phosphate rock yet to be moved; in the West, grain; in the Northwest, lumber; in the far North, pulpwood; in the Middle West, coal. So, while the railroad executive is laying off men and retrenching, at the same time he is quietly getting his locomotives and freight cars into shape for the day not far distant when normal traffic again will command his equipment. No industry is so wholly dependent upon the widespread prosperity of the country as are the railroads, and yet the railroads are utilizing the present seeming adversity as a stepping stone to greater future things. Here is thought and consolation for the business man who just now thinks that he cannot see his way out of the commercial quagmire.

Despite the present lull the average railroad executive is confident and hastens upon the tasks of 1921 with a bound. A year ago, figuratively, he was a palsied old man, broken in health and purse, almost friendless, with the threat of dispossession of his own home darkening his New Year. Today, he has almost completely regained his health, his finances are on the mend, he has lifted the mortgage on the old homestead, can hold his head high and look his neighbors in the eye. Who is he, then, to become fearful over the inevitable settling of the silt that has kept the industrial and social waters roily for nearly four years?

The improved status of the railroads of the United States at this New Year stands out in bolder relief against the background of one year ago. Then, at the last minute, the President had fixed March 1 instead of Jan. 1 as the date for the transfer of the railroads from government control to their owners, and the fate of the legislation necessary to tide the carriers over the transitory period hung in the balance. At this New Year the Cummins-Esch act is functioning fully, the private owners are once more in command, and the cloud of nationalization seems to have been dispelled. One year ago the carriers were not paying their own way, they were living off the treasury of the United States; now, the carriers are again a paying proposition and they have the assurance that if the present rates do not net them 6 per cent on their valuation in the aggregate the interstate commerce commission will readjust them so they will. The year 1920 dawned with labor restive and menacing the stability of the entire railroad structure; the year 1921 finds the railroads once more with labor well in hand, efficiency increasing and morale greatly bolstered. And greater than all these contrasts that are favorable to the opening of 1921 are the sympathetic co-operation the railroads have gained from the public and the restored confidence of the railroad executives in themselves. It requires a long and painstaking search through railroad history to reveal a turn of the year more promising than the present one.

January and February last year passed with the railroads struggling under the backlash of the bituminous coal strike of 1919, and congress debating the Cummins-Esch bill, which was being framed to restore the railroads to their owners and lend a hand

during their convalescence after government control. On Feb. 28 the President signed the bill, and at midnight Feb. 29 he relinquished control. Then ensued weeks and months of unscrambling, of unraveling finances and of restoring equipment to home lines, tasks not yet completed.

Failure to obtain wage advances as far back as the fall of 1919 and dissatisfaction with the slow-moving machinery set up in the Cummins-Esch act kept labor in a turmoil, and finally, in mid-April, a group of radical switchmen took matters in their own hands and proceeded to tie up traffic moving in and out of Chicago. When the so-called outlaw strike seemed to burn out in the Middle West it burst into full flame in the East and, though quenched, it continued to smolder until the railroad labor board on July 20 authorized wage increases aggregating $618,000,000 annually. As Clyde B. Aitchison, a member of the interstate commerce commission has aptly said, "the general public will never know how close the rail and water transportation systems of the United States came to a complete cessation of functioning in the industrial heart of the country as the result of the strikes which began in April and continued in diminishing force until mid-summer."

All this while the interstate commerce commission was engrossed with the rate problem. The rates and fares authorized on June 25, 1918, were still in force but were far from adequate; in fact, month by month the carriers were piling up deficits running into the millions. Under the terms of the new transportation act, the railroads were to be assured of an aggregate return of $75,000,000 a month in the 6-month period immediately following March 1, this return to be paid from the United States treasury. For statistical purposes, this return amounted to $450,000,000, and in the 6-month period the actual deficit of the railroads was slightly more than $206,000,000, making the aggregate cost for the period $656,000,000. As the Cummins-Esch act called for a 5½ per cent return to the carriers, with the option of an additional one-half of 1 per cent for improvements, the problem of the interstate commerce commission was to ascertain the aggregate value upon which to determine the revenue needed to produce this 6 per cent return. The railroads submitted $20,040,572,611 as the value of their physical properties. This the commission scaled down to $18,900,000,000, and on July 29 it authorized these rate increases, effective on five days' notice:

Upon freight traffic in the eastern group, 40 per cent; in the western group, 35 per cent; in the southern group, 25 per cent; in the mountain-Pacific group, 25 per cent; and upon traffic between the various groups, 33 1-3 per cent.

Upon all passenger traffic and accessory services, 20 per cent upon all sleeping, parlor and other special equipment fares, a sur-charge of 50 per cent, to accrue to the carrier.

These rate increases were put into effect Aug. 26. A deficit of some $156,000,000 in August was turned into a net earning of $80,000,000 in September for all railroads. The October net earnings topped $100,000,000. Some complaint is heard that the increases are inadequate, but it is generally agreed the new rates have not yet been given a fair trial under normal conditions. The possible exception is the New England situation, which presents difficulties peculiar to that region.

Out of the labor troubles fomented in April by the radical switchmen arose the series of emergency service orders, which dominated the car situation from May 1 to Dec. 1. The transportation act of 1920 gave the interstate commerce commission enlarged powers with respect to car service, this term including the use, control, supply, movement, distribution exchange, interchange and return of locomotives, cars and other equipment of the carriers. In its annual report, the interstate commerce commission aptly describes its powers in this respect as follows:

"Whenever we are of opinion that shortage of equipment, congestion of traffic, or other emergency requiring immediate action exists in any section of the country, we may, with or without complaint, answer, hearing or report, suspend the rules, regulations and practices of carriers with respect to car service and (1) give just and reasonable directions with respect to car service without regard to ownership as between the carriers: (2) require the joint or common use of terminals, including main-line tracks; (3) give directions for preference or priority in transportation, embargoes or movement of traffic under permits at such time and for such periods as we may determine; and (4) give such just and reasonable directions with respect to the handling, routing and movement of traffic of carriers by railroad as in our opinion will best promote the service in the interest of the public and the commerce of the people, and upon such terms as between the carriers as they may agree upon or, in the event of their disagreement, as we may, after subsequent hearing, find to be just and reasonable."

From the signing of the armistice to Aug. 1, 1919, there was a surplus of cars. Beginning Aug. 1, 1919, the revival in business demanded equipment in excess of the supply. This condition prevailed Feb. 29, 1920, when the roads were turned back to their owners by the railroad administration. Not only were the railroads short of equipment but terminals and gateways also became congested in April and early May through the switchmen's strike, and on May 15 the principal railroad executives went before the interstate commerce commission and its newly-organized bureau of service to ask that the commission invoke its emergency powers. These executives petitioned the commission to exercise its emergency powers "with respect to (a) the giving of priority and preference in movement of necessary food,

Outlook for the Railroads in 1921

PRESENT freight rates are likely to hold throughout year with the possible exception of those in New England in case the trunk lines refuse New England roads a greater percentage of revenue.

* * *

Service will show much improvement over 1920, with the car supply seemingly ample, railroad efficiency higher, reconsignments unlimited and various carriers actively competing for business.

* * *

Purchasers of equipment and making of improvements and betterments likely will be above normal with the carriers' finances stabilized, all of 1920 needs placed and enlarged budgets possible for 1921.

* * *

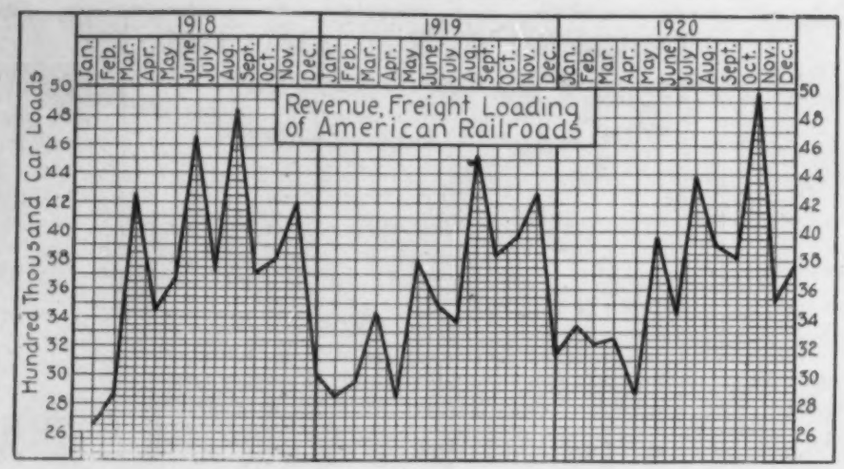
Improvements are likely to be centered on enlargement of terminals and gateways and addition of passing tracks.

* * *

Decision will be made whether the interstate commerce commission is the real governing factor over railroads or whether it must share this power with 48 state commissions. Chances favor enlarged powers for the federal commission at expense of the states.

* * *

Cummins-Esch act likely will stand, with possible amendments only strengthening the act. Congress again will be asked to insert antistrike provision over the protest of organized labor.


1918
1919
1920
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Revenue Freight Loading of American Railroads
Hundred Thousand Car Loads
50 48 46 44 42 40 38 36 34 32 30 28 26

AS A BUSINESS BAROMETER, THESE FIGURES REPLACE THE IDLE CAR STATISTICS

fuel, and other vital commodities; (b) the relocation of empty equipment; (c) the necessary postponement and delay of loading or movement of other less important commodities and (d) the reduction of existing passenger service as far as might be necessary, in order (e) that to the extent necessary to accomplish these purposes the carriers might be relieved from the operation of federal and state laws and orders recognized under ordinary transportation conditions."

Twenty-two service orders resulted. Among other things, the interstate commerce commission required the diversion of stated bituminous coal tonnages to the Coal & Ore exchange, Cleveland, for shipment to the Northwest by way of the Great Lakes; gave priority on shipments of bituminous coal to New England and to public utilities and ceded to the coal operators preference on open top equipment, with modifications from time to time as the fuel situation warranted. Relocation of freight equipment and the movement of box cars to the West and coal cars to the East also was accomplished. In all these service orders, the fuel situation was interwoven, and this necessarily brought in the question of prices. With the service orders now mere memories, it appears that the interstate commerce commission acted according to its best light and sought to accomplish the greatest good for the greatest number. There is no doubt, though, that the commission was mistaken in regard to the fuel situation as it applied to the Northwest, New England and the public utilities. The greatest blow dealt the iron and steel industry came through the diversion of most open top cars to the coal trade, in midsummer, the iron and steel trade had call on only approximately 10 per cent of all the open top equipment.

Whether the formation of the railroad labor board in March, in compliance with the Cummins-Esch act, marked a real step in advance in solving the labor problem, cannot yet be determined, but at any rate it proved expedient. On this board are three representatives of the railroads, three of the employes and three of the public. The first decision of this board was announced on July 20, in which $618,000,000 was added annually to the wages of railroad labor.

Coincident with the improvement in the car situation as the summer wore on came relief from the labor factor. The railroad executives gradually reasserted their control. Late in October and early in November business began to fall off here and there, and the labor market to ease up. Immediately came greater efficiency in the railroad shops. Workmen produced more as their jobs came into the danger zone. It was found that oftentimes production was maintained despite reductions in personnel. The first to be laid off were the nonproducers. As the great automobile fac-

IN IDLE PERIODS THESE CARS ARE EMPTY. IN BUSY, CONGESTED TIMES THEY ARE LOADED WAITING MOTIVE POWER, LABOR OR TERMINAL SPACE

tories in and around Detroit slackened production, the skilled mechanics, who had left the railroads for more lucrative posts during the war, returned. Piece-work, to an extent, was re-established. In many shops the actual 8-hour day was established for the first time since the passage of the Adamson act.

The turn of the new year sees the carriers once more dominating the labor situation, and finds labor more plentiful and more efficient.

A problem of Herculean proportions faced the carriers in the unscrambling of equipment at the termination of government operation. Less than 21 per cent of the 2,500,000 freight cars in the United States was on their home lines. A record-breaking volume of traffic was presented, but this peak load, it was easy to be seen, would be far passed by the time new cars and locomotives were built. The only avenue of escape was more careful use of the existing equipment. Leading railroad executives got together, formed an advisory committee and laid down these three aims:

To bring the average daily minimum movement of freight cars up to not less than 30 miles a day.

To bring the average loading of freight cars up to 30 tons.

To reduce bad-order cars to not more than 4 per cent of the total owned.

For all practical purposes, the first two of these aims had been accomplished by Sept. 1. By late December the number of bad-order cars had not yet been reduced to 4 per cent but with labor more plentiful and the demand for cars lessening, this goal appears to be within hailing distance. The records of the 10 months of private control uniformly have surpassed the preceding 10 months of government control. The carriers under private operation today are hauling more freight moving it more quickly and at less cost than under federal control.

The accomodation of loaded cars when the roads were turned back was 103,237. The high mark was reached April 16 when 288,152 cars were loaded but unmoved because of the switchmen's strike. On Nov. 1 this accumulation was down to 40,000 cars, and on Dec. 1 to approximately 20,000. Normally the loaded car accumulation is from 4000 to 5000. On March 1, the average miles traveled per freight car per day was 23.8. In June the 25-mile mark was passed and in September the 30-miles-per-day mark was attained. Similarly, where the average loading per car in March was 28.3 tons, by Sept. 1 it had been increased to 29.8 tons. In August the railroads set a world's record in bringing the net tonnage per freight train up to 788 tons. Where the net ton-miles per car-day in March was 487, in September it had advanced to not quite 575. This added car efficiency had the effect of making 370,000 more freight cars available.

The latest statistics of the interstate commerce commission place 2,368,876 freight cars to the credit of the railroads, divided as follows: 1,062,836 box cars, 1,009,871 open-top cars, 107,824 flat cars, 83,000 stock cars, 60,204 refrigerator cars and 54,141 miscellaneous cars. Privately owned freight cars total 155,468, bringing the total available around 2,500,000. To increase this equipment, the interstate commerce commission is utilizing its $300,000,000 revolving fund, established by the Cummins-Esch act to aid the carriers in making additions and betterments, providing equipment and meeting maturities. It has been held that inability of a railroad to obtain funds except at high interest rates constitutes the inability required by the act as a condition to obtaining a loan. On June 7 the interstate commerce commission announced the apportionment of this revolving fund as follows:

To aid in the acquisition of freight cars	$75,000,000
To aid in the acquisition of freight and switching locomotives	50,000,000
To [illegible] amount of additions and betterments to promote the movement of freight cars	73,000,000
To aid in the meeting of maturing indebtedness	50,000,000
Appropriation for short-line railroads	12,000,000
Temporary reserve for claims and judgments against the United States arising out of federal control	40,000,000
Total	$300,000,000

Up to Dec. 1 a total of $115,767,710 has been loaned in this manner to the various railroads. It is thought on all sides that large equipment orders will be placed by the railroads in the opening months of 1921, as projects have been held in abeyance in order to get them in the 1921 appropriation instead of that for 1920. The action of the treasury department in withholding some $400,000,000 of the $656,000,000 due the railroads under the 6-months guaranty has delayed equipment orders.

No development in the railroad situation in 1920 was more important than that of the conflict of the interstate commerce commission with the various state railroad and utility commissions. In announcing its rate advances on July 29, the financial calculations of the commission were based upon the belief that all the states would advance intrastate rates the

WHEN THE RAILROADS ARE BUSY ALMOST EVERY AVAILABLE TRACK IS USED TO MOVE THE TRAFFIC

same percentage as interstate ones in their regions. Instead, only 24 states allowed the full advances in freight rates and 23 the full advance in passenger rates. In some states, commissions refused the application of the carriers for the corresponding increase in rates; in others, state laws proved a bar. Various hearings were held and finally in November the interstate commerce commission ordered passenger rates in Illinois, Wisconsin and New York advanced the full 20 per cent. In the Shreveport case, the interstate commerce commission declared a stated intrastate rate discriminatory to a stated interstate one, and ordered the discrimination removed. It is claimed by the commission that the Cummins-Esch act gives it full authority to issue a blanket order declaring all intrastate rates discriminatory. The general opinion is that the states are fighting a losing battle. It does not yet appear that the loss in revenue through failure of the states to allow the full measure of interstate rate advances will make higher interstate rates necessary. The lineup of the 48 state on freight rates is as follows:

Increases approved in full	34
Increases approved with exceptions	17
Smaller percentage increases than allowed by interstate commerce commission approved by	5
All increase denied	2
Total	48

As to passenger rates, the states are divided as follows:

Increases approved in full	23
Increases approved with exceptions	7
No increase allowed because statutory provisions prevent action by state commissions	13
Increases denied	3
Increases denied in part	2
Total	48

No small amount of criticism has been heaped upon the railroads in the past year through their attempts to increase demurrage and limit reconsignments. By some it has been charged that the carriers have fallen to the level of porters and hat-boys in demanding payment for acts heretofore rendered as a part of a carrier's service. It must be borne in mind that the purpose governing the reconsignment regulations, for instance, was not that of increased revenue but of penalizing undue use and misuse of equipment. The limit on reconsignments and the charge for reconsignments in excess of one on any single shipment were removed Dec. 1. At that time the commission also refused to sanction increased demurrage. With normal competitive conditions at hand, it may be taken for granted that the prewar measure of service in the way of demurrage, reconsignment and like privileges will be restored.

What does 1921 hold forth, especially for the iron and steel industry, from the railroads?

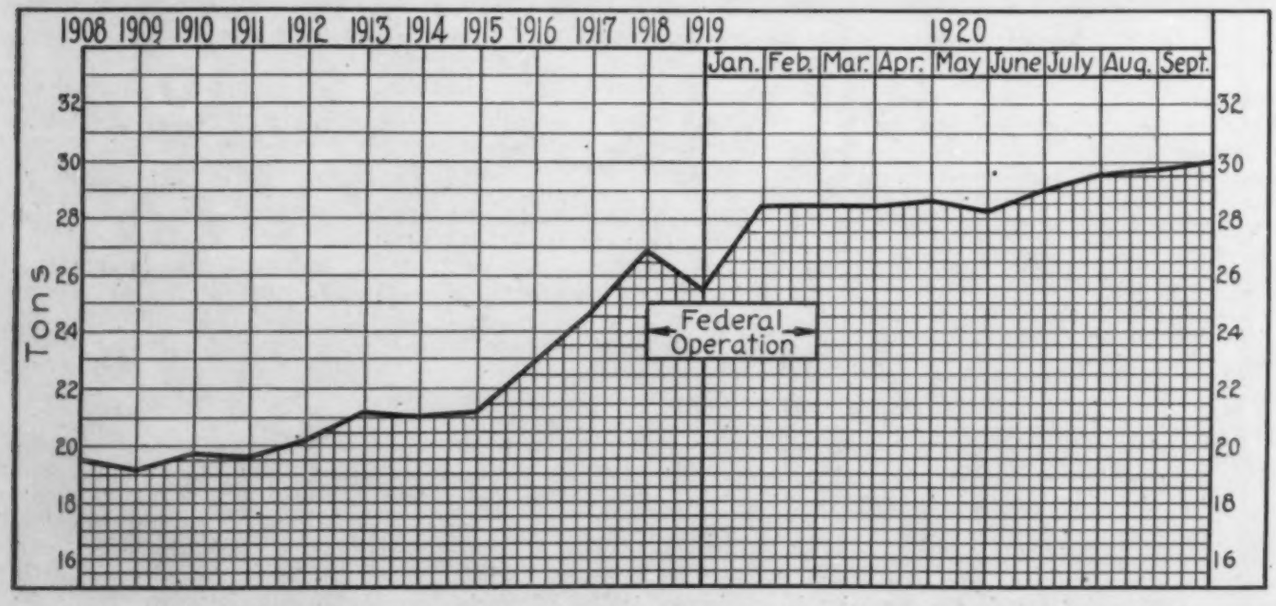
The chances are that the present freight rates will obtain throughout the year. Minor adjustments probably will be made, affecting localities only. The New England roads, which are now demanding a greater percentage of freight revenue from the trunk lines, may succeed in this attempt, with the alternative a slight rise in New England rates For the country as a whole, the only relief from the present rates in 1921 appears to be elimination of the tax on freight bills.

Service should show a marked improvement. Labor should be more efficient this year than last, it is more plentiful, and its morale is higher. More equipment, both in additions and in repaired cars and locomotives, will be available. Terminals have proved to be the neck of the bottle, and steps are underway to remedy this. Instead of business seeking the railroads, the railroads in 1921 should be seeking business. This should restore the full measure of prewar demurrage and reconsignment, and accord to shippers the service to which they are accustomed.

Important railroad legislation may be conspicuous by its absence. The Republican party wrote the Cummins-Esch bill and was restored to power in the face of an adverse campaign by organized labor. The principal features of the act will no doubt stand throughout the year. It is announced that the antistrike provision will be revived. An attempt likewise will be made to insert the compulsory consolidation clause.

Attention in the way of improvements will be centered on enlarging terminals and adding passing tracks, rather than main line extensions. It was the inability of the carriers to move loaded cars through their terminals and gateways that led to the promulgation of the interstate commerce commission's service orders. Because of the congestion at terminals, freight cars at present are in actual transit only 10 per cent of the time. This problem is expected to be attacked vigorously in 1921.

It is no exaggeration to say that even the faintest ray of hope for bettered service would be an improvement over the turn of 1920. This, then makes the outlook for 1921 all the brighter. These arteries of commerce once more appear to be functioning in their appointed way. Instead of limiting 1921 business and commerce, the carriers are in position to lead it.



THE RAILROADS' EFFORTS TO INCREASE CAR LOADING ARE BEING REWARDED AS SHOWN IN THIS CHART OF AVERAGE CARLOADS

"Going to work" in an eastern industrial district. Iron and steel producers are doing their best to keep their men busy despite depression

Wages Working to Normal Basis

Elimination of Bonuses and Extra Pay for Overtime First Step Toward General Reduction Impending in Steel Industry—Companies Striving To Keep Down Unemployment—Extension of Open Shop, Feature of Year

THE outstanding features of the labor situation as industry faces the new year, are the widespread reductions in wages, 10 to 25 per cent, unemployment, and employers everywhere moving toward the adoption of the open shop. While a feeling of doubt prevails as to business in the next quarter, there is some satisfaction to be derived from the fact that an even balance as between labor and other costs is being maintained; and that when readjustments will have been made and trade is resumed, the labor situation also will have been considerably improved.

The reported increased efficiency and tractability of labor, due to the reason that men are hunting jobs and jobs are not hunting men, as contrasted with conditions a few months ago, may be counted upon so long as there is a plentiful supply of workmen. But the very condition which employers seek most, full operations, discounts it as a permanent factor. The most that can be said of the present situation is that it offers opportunities for orderly readjustments to a normal basis, and that too radical actions on the part of employers, easily may be obstructive to the bringing about of permanent benefits for all interests concerned.

Considering the dearth of business and slowing up of plant operations throughout the country, the great majority of workmen thus far have fared exceedingly well. With most industries passing through a critical period, the number of unemployed, estimated as 2,000,000 to 3,000,000 men, has not reached serious proportions, nor is it likely to do so if employers continue as they have been doing, in rearranging operating schedules so as to afford some work for most, if not all of the men in their plants.

This desire and tendency to keep down the number of unemployed is significant. A little while ago, the impression was given in some quarters that employers would lay off men indiscriminately, to re-employ them at a much lower rate. Few employers adopted this as a policy, regardless of other consideration, while a far greater number have been actuated by a knowledge that idle men represent idle machines, diminished buying power and discontent, which would not be conducive to present composure or to ultimate prosperity. This is especially true in the iron and steel industry.

Hardship Would Be Avoided

A resumption of trade within the next few months would mean the reabsorption of the unemployed without any great amount of hardship having been sustained; in fact, less than organized labor brought on itself recently through ill-timed strikes.

An important point in connection with the reduction of wages, is that there have been comparatively few protests by the workmen and in only one instance in the industry have the men whose wages were cut refused to return for work. Recent reductions have affected most operatives whose organizations have been particularly insistent in the past four years in wage increases. It suggests that due to unemployment, and to the fact that prices of many commodities have been reduced, labor has become reconciled to a reasonable readjustment.

Organized labor, however, believes that the reductions will lead to dissatisfaction and that this will improve its position numerically. No doubt, a precipitous decline would have such an effect, but wages are moving to lower levels slowly. Reports are frequent to the effect that employers announce reductions in wages simultaneously with cuts in the prices of their products sold to wholesalers, the effect being the same as though wages were reduced a considerable time before prices could be reduced to ultimate consumers. In the steel industry, however, no general change has been made in the schedule of wages and none at all as yet by some of the leading interests, while prices of practically all products have been marked down, many of them to the minimum level for the reconstruction period established by the industrial board, two years ago. The tendency in the industry is to keep the faith with labor—reductions in the cost of living first, then wage reductions with the former greatly in the lead with respect to both time and comparative levels.

While several steel companies recently announced reductions averaging about 20 per cent, the changes thus far put in effect by others has been restricted to the abolishment of extra pay for overtime work, elimination of bonuses and the re-establishment of the basic 10 or 12-hour day. Practically all companies are preparing to revise wage schedules in conformity with reduction already made in the cost of living and lower price levels of their products, and new rates are likely to go in effect soon after Jan. 1; although the leading interest may not make the change until spring. Nowhere, however, has it been charged, as it has in regard to some other industries, that iron or steel manufacturers have manipulated employment

conditions to make an arbitrary or unnecessary cut in wages.

By far the most important aspects of the labor situation today, is the issue pertaining to the open shop; and there is a general disposition to gage the effect on that issue. Employers now are supposed to be in a position to dictate more freely to labor as to the conditions under which work will be offered, but it does not appear that any great advantage has been attained thus far, and in some trades, none at all. The uncertainties of the period are tending to make employes more considerate, and put more effort into their work. This has enabled employers to offer products at reduced prices, and keep their men busy. The individual contract system is being followed out more extensively than heretofore, and employers associations are pushing their campaign for the open shop. On the other hand some of the latter profess to see greater difficulties ahead, should this movement become too aggressive with the change of employment conditions. Organized labor is threatening strikes in basic industries; it is conducting publicity campaigns, warning the public that if employers sieze opportunities in the present period of depression to break up unions, it will retaliate.

Defer Open Shop Federation

Following the recent announcement of the National Association of Manufacturers that it had re-established an open shop department, the Associated Employers of Indianapolis abandoned its proposals to federate all American plan associations. In response to suggestions from the community associations, the American plan committee of the Associated Employers planned co-operative action as early as May, 1920. Correspondence was carried on with the associations, and they were taking formal action pledging their support. A call for a convention of representatives was about to be issued when the American plan committee decided to wait.

While the plans for the federation were taking shape, some of the leaders of the established national associations expressed the opinion that so much agitation and organization was unwise and would create antagonism. They informed the Associated Employers and community associations that the strength of the open shop movement was due to its spontaneity, and the appearance of a new national association would give organized labor the opportunity it desired to start counter propaganda on the ground that capital was making preparations to curtail the power of trade unions.

Many of the newly organized local associations, however, were impatient for results. They were making pointed references to the effect that the national bodies were not aggressive enough, and not accomplishing the purposes for which they were organized, possibly not being acquainted fully with the efforts put forth by those associations.

The American plan committee, of the Associated Employers announced that if one of the established national organizations desired to take the lead in unifying the local bodies, then the aim it sought would have been accomplished. With the re-establishment of the open shop department of the National Association of Manufacturers, the Indianapolis organization withdrew, making the following statement to the local associations:

"We wish to emphasize that the Associated Employers of Indianapolis fully realizes the urgent need and widespread demand for efficient co-operative effort among the respective local employers associations throughout the country, and in event the desired results are not finally obtained through existing agencies this association stands ready at any time to again take the initiative and proceed to carry its original plans to a successful conclusion."

At the same time it urged the various associations to co-operate with the National Association of Manufacturers. In announcing its plans, the committee in charge of the department stated that it was created for the purpose of:

The collection, compilation and dissemination of information data and discussion regarding the open shop and its essential relation to our national ideals and institutions and to industrial stability, productivity and national progress;

By initiating, encouraging or fostering local movements for the maintenance or extension of open shop operation or the spread of open shop principles;

By co-operation with different bodies, national or local, devoted to these ends and by furthering such measure to secure co-ordinated effort on the part of such bodies as may seem wise and practicable.

By such further means as may be decided upon by the board of directors.

This organization is not assuming any authority over the local bodies, nor is there any purpose to do so, its function being merely to co-operate with and encourage them. The only difference between this plan and that of the Associated Employers is that the local associations are not affiliated with one another in an organized movement, nor are they under specific obligations to one another, although they are promised the active support of a national association. The arrangement is based on the assumption that what is needed is not more organization, but more co-operation; that new machinery is not necessary for greater efficiency and that conservatism is better than an unnecessary display of aggression.

The tendency toward unification is manifest in other directions; for instance, in the numerous efforts to organize associations in the respective states. Some of the local associations express enthusiasm for state and district organizations and a number now are in process of formation. The local bodies believe that by narrowing the field their problems will be easier to solve, especially as the latter relate to legislative and public policies.

Organized labor is losing no time or opportunity in promoting counter proganda. Wherever new associations of employers have been formed, or old ones have become more active, labor leaders have launched drives, first to strengthen their own forces and prevent the establishment of the contract system, and second, to convince the public that employers have in mind ulterior purposes in insisting on the open shop. It is estimated that trade unions now have available approximately $10,000,000 for organization and publicity purposes, not including the sums paid as salaries to organizers. The International Association of Machinists last summer began to raise $4,200,000 a year by assessing its members $1 a month, while other internationals affiliated with the federation are levying special assessments. In Cleveland, following the organization of the American Plan association recently, the trade unions succeeded in getting much publicity in the press to the effect that they were being pushed to the wall. They asked union members and sympathizers to donate to a defense fund and subsequently announced that while only $50,000 was requested, the amount subscribed would reach nearer $75,000.

Raise Funds to Organize Trades

The American federation at its annual convention in Montreal last June, appropriated $795,000, not including the salaries of officers or organizers, to organize various crafts and conduct strikes, the services of many organizers being donated "to the cause." The International Molders' union reported that it had spent to April 30, 1920, $1,117,242.38 in conducting strikes for shorter hours, higher wages and recognition. The sum of $25,000 was appropriated by the federation, and the services of five organizers were contributed to organize bookkeepers, stenographers and accountants; $30,000 and five organizers for clerks; $35,000 and two organizers for laundry workers; $10,000 for meat cutters and butchers; $250,000 and 18 organizers

for tobacco workers; $100,000 to aid the machinists and metal trade unions; $50,000 and two organizers for jewelry workers; $50,000 and five organizers for candy makers; $100,000 for hotel and restaurant workers; $30,000 and four organizers for glove workers; $20,000 and three organizers for freight handlers, and various smaller appropriations. In addition, it was decided to raise $3,000,000 to finance a contemplated general organization movement of the Automobile, Aircraft and Vehicle Workers, "and iron and steel workers." All of such sums are in addition to those which may be raised by local trade unions.

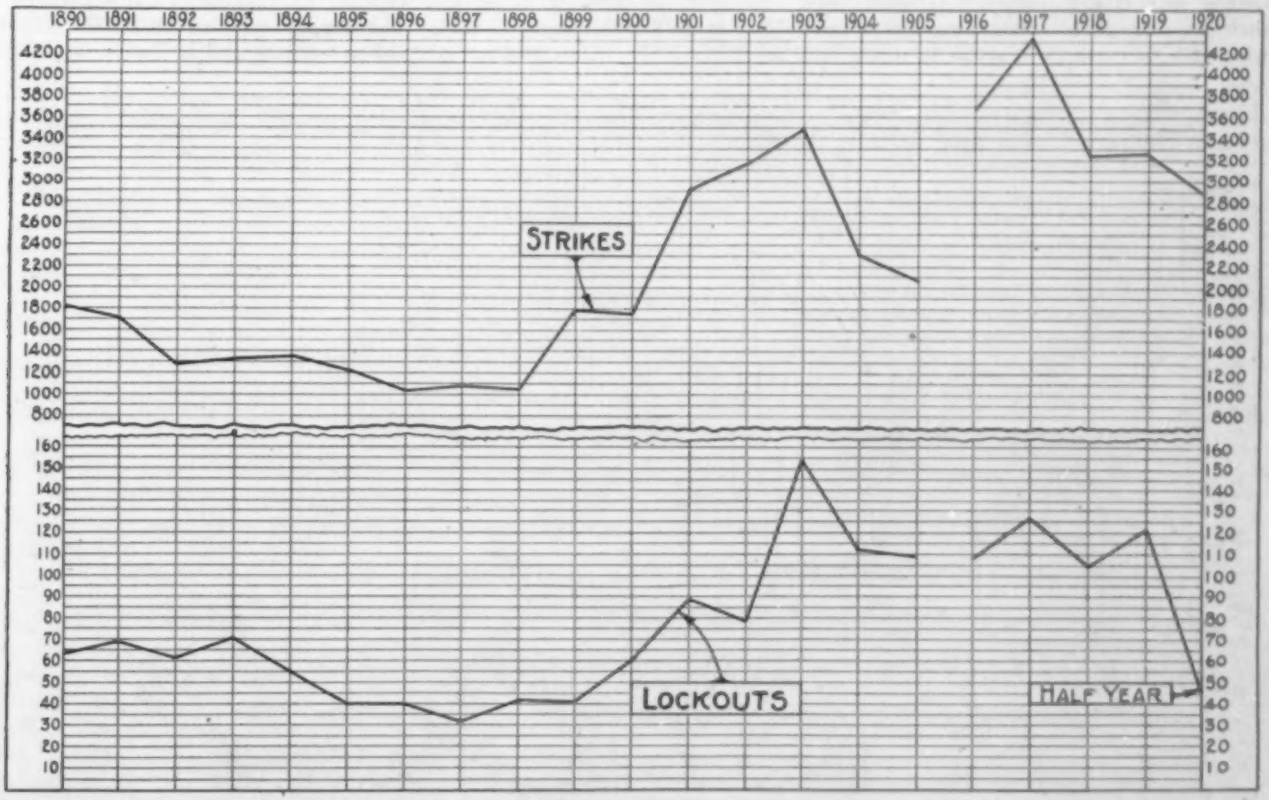
The American federation is composed of five general departments; 682 local department councils; 110 national and international unions; 1286 local trade and federated unions; 46 state federations; 926 city central labor unions, and 26,741 locals. Acting on President Gompers' statement that organized labor "stands ready and willing to fight any attempt to break down the democracy already achieved in industry," these trade unions are making special efforts to stem the tide of sentiment for the open shop, in support of which there are 541 associations of employers, including 23 nationals.

As a preliminary to the inauguration of the campaign, the executive council of the American federation has considered it necessary to do something to retrieve public confidence. The many absurd situations in which trade unions became involved, the countless number of minor quarrels which served only to demonstrate the arrogance of petty labor leaders, were bringing the federation into disrepute fully as much as were the efforts of the intellectuals "boring from within." It became necessary for the federation for the first time in its existence, to make a tacit admission of inherent faults and difficulties by consulting men whose views differed from their own, but whose sympathies it was desirable to retain. By stating that it seeks co-operation with industrial engineers, the federation hopes the public will appreciate the fact that it has potential powers for good, as well as evil; that the public will enter again into the twilight zone with respect to the closed shop, even if it cannot support such a policy in the light of clear reason; and will condone the frailties of the federation's satellites. The federation cannot chastise them; on one hand, it must encourage them for the purpose of "organization"; while on the other, it is proposing co-operation with industrial engineers. The conferences were viewed as a bid for public sympathy, in the hope that organized labor would be lifted to a higher plane of respectability.

In Minneapolis recently, the proprietor of a motion picture theater decided that he would have to operate his projecting machine as well as attend to his usual duties as manager, because patronage had fallen off, due to competition. The next day a union picket was walking back and forth in front of his theatre, holding aloft on a stick a placard announcing that the proprietor was "unfair." The union claimed that he could not operate his own machine; that he would have to join the union or employ a union operator. The Citizens alliance brought this case to the attention of the public with the result that in a few days the theatre was crowded. The protest against the picket continued so that the proprietor found it necessary to employ an operator. He paid the operator substantially what union operators were paid, though after his experience with the union and its pickets, he could scarcely be expected to employ a union operator. The picket continued to walk in front of the theatre, while the effect was just the reverse of what the union intended.

This is a little incident, one of many which have received the attention of the public recently, cited merely to illustrate the point, that a great number of the bosses of organized labor lack the ability to distinguish between what is reasonable and unreasonable in the simplest problems brought before them.

An employment manager was asked for his views on the federation's pro-



STRIKES AND LOCKOUTS IN THE UNITED STATES AS REPORTED BY THE DEPARTMENT OF LABOR. COMPLETE RECORDS WERE NOT KEPT FROM 1906 TO 1915 INCLUSIVE

posal that the industrial engineering fraternity co-operate with it.

"Not definite enough as yet," he said. "In the first place, labor unions are too prone to be antagonistic to any reform for which it cannot take entire credit; or rather, its leaders will not get behind any movement which may benefit the working man, yet which would not continue them in office. For instance, they oppose the shop committee system of representation, which offers some means for co-operation between employer and employe. It is an unholy device merely because professional trade union organizers cannot 'sit in.' Assuming that we should wish to co-operate with organized bodies of working men, have the trade union's men who are willing to put aside bias, men who have the training and experience necessary to qualify them to deal with our problems, or courageous enough to tell their men when they are wrong? With whom may we co-operate? Organizers, walking delegates and officers of the union, or the men who work in our shops?

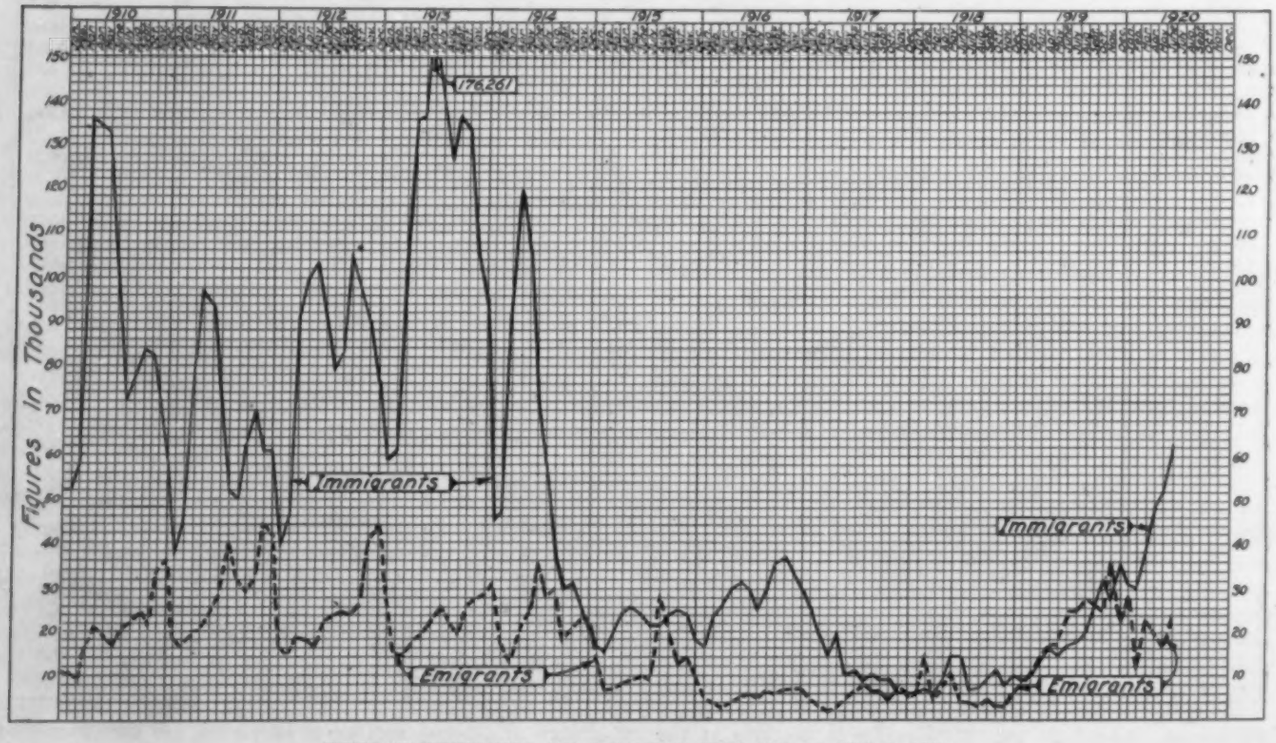
"Labor unions will not tolerate the piece work system, or any scientific means for grading or encouraging skill and individual effort. As constituted at present, most of them are merely fighting organizations, honeycombed with agitators and grafters. Many men in the organized labor movement are sincere, sensible and conservative; when their number predominates employers who wish to close their shops to non-union labor may work out some system for increasing production. The difficulty of this scheme is that it does not consider the nonunion workman worthy of attention. Indeed, if we attempt to co-operate with him, then we may not attempt to co-operate with the unions. The 'co-operation' that we are offered is a pleasant sounding word for forcing nonunion men into the ranks of organized labor."

More industrial plants have established shop councils or the employe representation system, and some interests are considering it in connection with their investigations and studies relating to the 8-hour day. Two large companies in the iron and steel industry have abandoned the employe representation plan after having given it two years' trial, while it will be remembered that Eugene G. Grace, president of the Bethlehem Steel Corp., in testifying before the Lockwood legisive investigating committee in New York recently stated that the experince of his company with employe representation was satisfactory. After 18 months of investigation, the Chamber of Commerce of Seattle reported that "something more than the open shop" is needed in industry, and recommended that employers try the shop committee system.

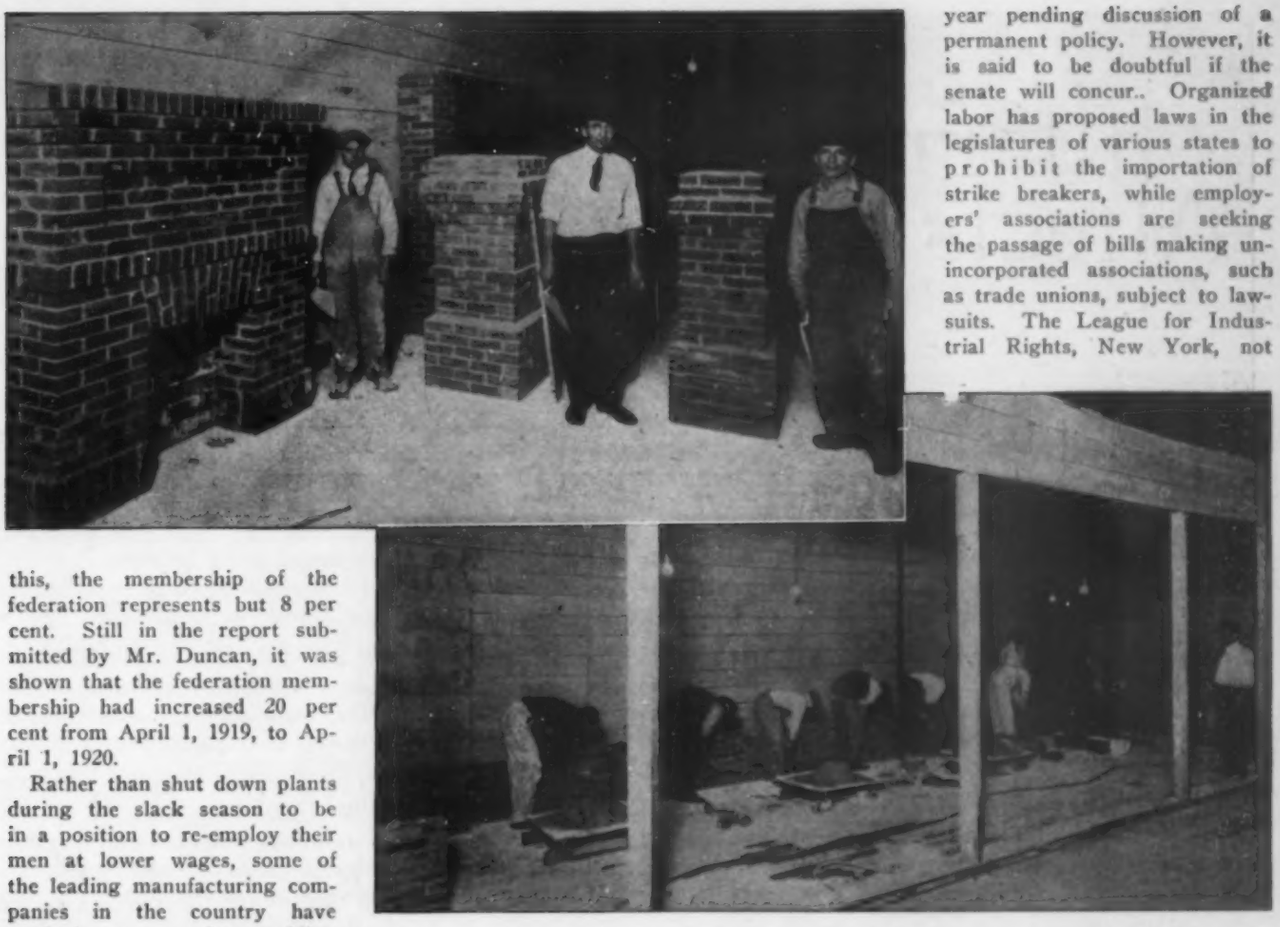
The number of strikes in the first six months of 1920 was 1813. It is estimated that the number in the last half of the year was 60 per cent of this. In 1919, the number of strikes was 3253; in 1918, 3232; in 1917, 4324; and in 1916, 3681. The number of lockouts in the first half of 1920 was 46; in 1919, 121; in 1918, 105; in 1917, 126; and in 1916, 108. These statistics were compiled in the department of labor. Data were collected by the department from 1881 to 1905, when for some reason, they were discontinued. Beginning in 1914, the bureau of labor statistics made an attempt to get the figures, but did not fully succeed until 1916. The only available figures from 1905 to 1916, are the partially complete reports of 556 strikes in 1914 and 985 in 1915, with no figures on lockouts in those years.

The strike bill in 1919, including loss of production and wages was approximately $2,000,000,000, of which $1,266,357,450 represents the loss in wages. The number of persons on strike in 1919, was greatly in excess of the number in any of the preceding years. Nine strikes alone involved 1,600,000 persons, while the total number involved in strikes and lockouts in that year was 4,112,507. The loss in wages and output in the first six months of 1920 was estimated at $104,443,370, and the number involved in strikes during the first five months, 273,643.

According to the report of James Duncan, first vice president of the American Federation of Labor, the federation has a membership of 4,078,740. Taking the United States census figures of 1920 showing a population of 106,000,000, the American Federation's membership represents but 4 per cent. The census revealed 50,000,000 classified as workers, and in comparison with



RECORD OF IMMIGRATION AND EMIGRATION FROM 1910 TO JULY 1, 1920



OPEN SHOP TRAINING SCHOOL

Organized labor's insistence on restricting apprenticeships and the supply of labor has led a number of employers' associations to provide classes where independent labor may be taught trades. Here is shown the night classes in bricklaying conducted by the Southwestern Open Shop association, Dallas, Tex. It suggests the possibility of extensions. Free instructions and tools are supplied and the men after learning their trade are given work at regular wages.

this, the membership of the federation represents but 8 per cent. Still in the report submitted by Mr. Duncan, it was shown that the federation membership had increased 20 per cent from April 1, 1919, to April 1, 1920.

Rather than shut down plants during the slack season to be in a position to re-employ their men at lower wages, some of the leading manufacturing companies in the country have worked out means for providing continuous employment. The number of jobless men in this country would be much larger at this period, it is said, were it not for the fact that certain large companies have solved the problem of how to keep their operatives busy when new orders are not coming in. In some districts diversified manufacturing interests also have served to keep down the number of unemployed; one plant absorbing those from another.

The International Harvester Co. has adopted a method for stabilizing its factory forces. It has diversified its products until now all its plants in normal times are on a 12-months basis with little fluctuation in the number of workers. The company has about 35,000 workers in its factories in the United States, and a sales force of approximately 4500. In 1902 the company was making nothing except harvest machinery. There was a seasonal rush and a seasonal slump. The sales organization particularly was affected by the normal period of slackness, and so were some of the plants, although in much less degree. So with a view to stabilizing its organization, the company began to launch out into lines that would keep the sales force busy the entire year. It took on the making of tractors, gas engines, cream separators and motor trucks, and a wider variety of implements, until today it has 54 classes of product in place of seven or 10, which it had 18 years ago. As a result, in normal times there is a continuity of work not only in the sales department, but in the factories as well. In one plant, when the dull period for one line of implements arrives, another line takes its place. The foundry work goes on the year round, and the assembling, packing and shipping run on an endless chain.

President Gompers recently stated to organized labor: "It is absolutely necessary for every national and international union, every state and city central and local union to impress upon the members of congress that American labor as well as all the people, should be protected from the menace of excess immigration. No other question is of such vital importance to the workers."

The strength of the movement in favor of the restriction of immigration was shown by the passage in December, of the bill by the house of representatives, suspending the inflow of aliens for one year pending discussion of a permanent policy. However, it is said to be doubtful if the senate will concur.. Organized labor has proposed laws in the legislatures of various states to prohibit the importation of strike breakers, while employers' associations are seeking the passage of bills making unincorporated associations, such as trade unions, subject to lawsuits. The League for Industrial Rights, New York, not only urges the state legislature to pass such bill, but has suggested another for the better protection of public welfare against unwarranted strikes and lockouts. Section 1 of the proposed bill states:

"The phrase 'unwarranted industrial warfare,' as used in this statute, shall mean a strike or lockout when carried on by or in respect to employes whose terms of employment are fixed by the state or the United States, or any political sub-division thereof; in violation of an agreement or for conditions of employment conflicting with an agreement between an employer and his employes, or any employer and any labor union; or in violation of any arbitration award, or for conditions of employment conflicting with the terms thereof; or to enforce terms of employment where a request therefor has not first been presented to the party from whom such terms are sought and a reasonable time given for the consideration; or where there is no trade dispute involving issues of direct benefit to the acting parties."

The year 1921 is likely to witness more intensive efforts at organization, both by employers and by organized labor with considerable new legislation proposed in the states and in congress by both, as well as measures designed to protect the interests of the general public.

Intermittent Operation Affects Metallurgical Practice.

Development of Metallurgy in Iron and Steelmaking Is Marked by Influence of Frequent Interruptions in 1920

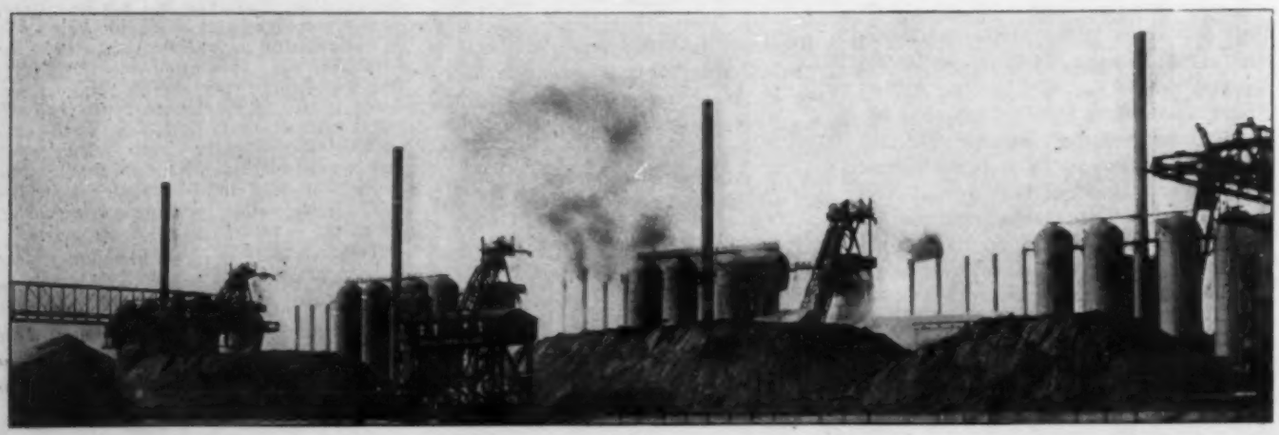
AMERICAN iron and steelmakers who successfully ran the gauntlet of 1920 should feel supremely confident of their ability to cope with the operating problems of the new year. During the past 12 months blast furnace and steelworks operators have had to contend with the after effects of a steel strike, acute industrial paralysis caused by transportation troubles, and the inactivity accompanying business depression. Each of these three situations brought new complications which have influenced the metallurgical progress of the iron and steel industry.

Because of the abnormal conditions in 1920, iron and steelmaking practice now is keyed up to meet unexpected interruptions in plant operation. Moreover, the hardships of the past year have emphasized the value of certain processes which might have passed unnoticed under normal conditions.

Blast furnacemen approach the work of 1921 with a better knowledge of methods of handling coke of varying quality; the advantage of higher blast heats is appreciated; progress is being made in successfully disposing of dry dust and wet sludge; slight modifications in furnace lines have been found to make the furnace operate more smoothly; and an advance has been made in manipulating the burden in order to counteract the increased sulphur content of iron ore.

Steelmakers are devoting much attention to fuel economy in the operation of their furnaces. Their experiments with various fuels in the open-hearth are prompted by a desire not only for economy but also for greater uniformtiy in the quality of steel produced. On account of the labor situation in 1920, some of the advantages of the duplex process were accentuated, and consequently much of the present metallurgical progress is centered upon the handling of metal in the various melting and refining furnaces. More than usual attention is being given to the possibility of purifying steel by improving the conditions under which it is handled in passing from the melting furnace to the ingot molds. Straining in the ladle, and new methods of pouring have been proposed, but actual tests have not been made.

Noteworthy advances are being made in some of the minor divisions of the iron and steel industry, particularly in foundries. The triplex process for making malleable iron now permits the use of malleable scrap, which heretofore was in little demand. During the year experiments with a new annealing process have given promise of a great reduction in the time of annealing malleable. In gray iron foundries, tests have shown that the sulphur content of the iron can be reduced by electric furnace treatment, but metallurgists differ on the advantage gained in this process.



Ironmakers Face Operating Problems

Practice in 1920 Indicates Tendency Toward Rescreening of Coke, Use of Higher Blast Heats, Improved Methods of Disposing of Dry Dust and Sludge, and Increased Efforts to Offset Sulphur Content of Ores

BY L. A. TOUZALIN

FROM the blast furnace operator's standpoint the outstanding feature of the year 1920 was the succession of marked irregularities of operating time and raw materials. The early part of the year was spent in overcoming the after-effects of the steel strike, which began on Sep. 22, 1919. Conditions promised to become normal again when suddenly the outlaw railroad strike complicated matters. In addition to this, the effect of irregular operation at the coal mines, and the many labor difficulties which affected production and transportation in general, were aggravated by a serious car shortage which threatened for a time to bring about an industrial crisis.

It is on account of these abnormal conditions that the chief problem in the operation of blast furnaces, during the year just ended, consisted of a study of ways and means of counteracting the deleterious effects of these many irregularities. In order to make a creditable showing, the blast furnace operator was compelled to exercise continual watchfulness and to pay strict atttention to details which, under normal times, might appear to be trivial.

Quality of Coke Varies

Undoubtedly the greatest variable which had to be dealt with was blast furnace coke. The irregular coal supply to the by-product ovens resulted in constantly varying mixtures and coking time. The physical and chemical properties of the coke produced, therefore, were extremely variable. In spite of receiving more or less efficient screening at most ovens the friability of the coke resulted in the accumulation of considerable breeze in cars on reaching the furnace. In order to overcome the bad effects of this breeze a number of furnace plants arranged for the rescreening of the coke at the stockhouse on its way to the skip tub. This treatment has been especially beneficial at furnaces located at some distance from the coke ovens, since it eliminates much breeze produced or accumulated in transit. The results of this procedure have on the whole been very gratifying and the practice will undoubtedly be adopted by many more plants during the coming year.

The nonuniformity of coke has brought out very clearly the extreme importance of proper distribution of materials charged into the furnace top. The segregation of course and fines is a constant source of danger, especially on furnaces without mechanical distributors. Many experiments have been made to correct this tendency by the employment of various baffling or deflecting devices to properly deliver the stream of stock and prevent such segregation.

The inadequacy of the present means of measuring the volume of blast delivered to a furnace has been keenly felt during the past year by many operators. Uniform distribution of the air blast to the tuyeres with reference to quantity as well as temperature, has received insufficient consideration, and the coming year will undoubtedly see more determined efforts made to control this factor of furnace operation.

Dry Dust Is Recovered

While it is true that the tendency toward cleaner gas and resulting higher blast heats has been growing steadily for a number of years, nevertheless it is certain that the troubles of the year just ended have emphasized the importance of these advantages. First of all, good blast furnace practice depends on uniformity of raw materials and operating conditions. Where such is not available, more conservative burning of the furnace is necessary. Statistics show that those furnaces which could obtain and profitably apply high blast heats, to take care of fluctuations, have made the best showing and have suffered less from the unfavorable fuel conditions of the year. The question as to the best method of disposing of the dry dust or the sludge recovered from dry cleaners and wet washers respectively, has received considerable attention. In neither case has a completely satisfactory method been put into actual practice, although enough work has been done to indicate that a solution of the problem is much nearer. A thickener has been used with satisfactory results to recover the iron bearing solids from waste washer water. This process promises to be very helpful, especially where the supply of water for cooling purpose, etc. is limited, or where the resulting polution prohibits the discharge of the waste washer water into rivers, lakes, etc. In addition to this advantage, the recovery of iron bearing solids from the washer water on furnaces using high percentages of physically fine ores will reduce the present furnace loss ly approximately 50 per cent. Little new work has been done during the past year on the best method of returning this recovered flue dust or sludge to the furnace top. One or two experimental plants were built to filter the sludge, but the results are not as yet known. The whole question of the disposal of dust or sludge is a very vital one, and one which may be confidently expected to be solved in the near future.

The steadily increasing physical fineness of the ores used has emphasized the desirability of certain modifications of furnace lines. The furnaces built during the last year in general have a larger hearth diameter and increased batter of the stack lining. Shortening of the bosh and increasing the bosh angle has been found to give a much smoother operating furnace. To explain this, a simple theory has been advanced showing how the fine ores fill the interstices of the coke charge, and therefore cause less contraction in the bulk of the charge, at the melting zone, than if the ore were present in the form of lumps before melting. The results obtained during the past year by several furnaces of this type prove beyond a doubt that the modifications made are of great practical benefit. It, therefore, seems safe to predict that the large hearth furnace has come to stay and that the future will see the adoption of these lines on many stacks at their next relinings.

Sulphur Problem Looms

The past year has continued the tendency toward a gradual deterioration of fuel, especially with regard to increasing sulphur content. As the lower sulphur coals are consumed this increase of sulphur in the coke is sure to become more and more pronounced in the future. Unless suitable precautions are taken this means a higher sulphur content in the iron produced. In many cases, the slag volume is increased to remedy this situation. Such procedure, however, results in increased coke consumption. Another method of correcting the trouble

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is to increase the basicity of the furnace cinder. The result in this case is a viscous, limy slag which takes care of the additional sulphur, but detracts from the smooth and uniform movement of stock through the furnace on account of the higher melting point of the slag produced. This means extra coke.

The most desirable way to counteract the effect of the increased sulphur, where the chemical specifications of the iron permit, is the addition of manganiferous material to the furnace charge. This results in a higher percentage of manganese oxide in the slag, increases the fluidity of the latter, and permits the use of a slag which, although more basic chemically, shows no material increase of viscosity. This method meets with the hearty approval of the majority of open-hearth men who maintain that the greater percentage of residual manganese in their bath reduces the amount of manganese addition required as a deoxidizer at the finish of the heat. Furthermore, that percentage of manganese which enters the slag as manganese oxide, during the heat, gives them a more fluid slag and one capable of easier working.

It has become a well established fact that within practical limits, say up to 3.0 per cent manganese in the pig iron, the sulphur content of the finished steel product is inversely proportional to the percentage of manganese in the charge. In view of this advantage coupled with the fact that use of such high manganese iron results in no disadvantages whatsoever in the physical qualities of the finished steel, the future desirability of high manganese basic iron for open-hearth use seems assured.

Steelmakers Experiment with Fuels

Attempt To Use Coke Oven Gas Unmixed with Other Fuels in Open-Hearth Furnace Attracts Widespread Attention—Powdered Coal Is Used More Extensively—Labor Problems Increase Advantages of Duplexing Process

FROM a metallurgical standpoint, the outstanding feature in steelmaking practice is the effort now being made to adapt various fuels to open-hearth furnaces. Most of the progress made in this direction can be traced to the desire of engineers to find methods of using the fuels most easily obtainable, but in a few cases the experimental work has revealed economies which give promise of influencing the future trend of open-hearth practice.

One development which has engaged the attention of metallurgists and open-hearth engineers is the burning of by-product coke oven gas in the open-hearth furnace unmixed with other fuels. It will be remembered that only a few years ago, American steelmakers adopted the practice of using coke oven gas and tar combined as open-hearth fuel. Previous to the introduction of these fuels in combination, gas and tar were used separately. The principal objection to the use of coke oven gas alone was the fact that after the benzol was removed the gas was robbed of its illuminating properties. The necessity of enriching the debenzolized gas with hydrocarbons to restore the illuminating power led to the addition of coal tar, and the combination was hailed by many authorities as an improvement over coke oven gas containing benzol or coal tar, each used alone.

Burns Coke Oven Gas Alone

Early in 1920 a 50-ton open-hearth furnace in the plant of the Steel Co. of Canada was slightly modified to permit the use of by-product coke oven gas unmixed with coal tar. This innovation probably would not have attracted widespread attention if it were not for the fact that the experimental furnace immediately showed remarkable economies in the consumption of fuel, reductions in the cost of maintenance, and a surprising increase in the life of the front and back walls.

As outlined in detail in another article beginning on page 17, the system introduced at Hamilton by the open-hearth superintendent, F. B. McKune, consists of introducing the gas through an ordinary producer gas port and allowing it to come in contact with high-temperature air which is diverted from the outside uptakes by dampers and forced through the center uptake. All of the downtakes at the other end of the furnace are left open to carry away the gases. The coke oven gas, entering through two 3-inch pipes under 8 ounces pressure, mixes readily with the swiftly moving stream of air and when the flame emerges from the nose of the port it reaches an intensity greatly exceeding that in usual practice.

The high velocity of the flame over the hearth insures a rapid transfer of heat and keeps the flame on the bath and away from the roof and walls. It is stated that the air and gas are so intimately mixed in the ports that no excess air for dilution need be introduced into the furnace. Because of the absence of excess oxygen and nitrogen over the hearth, the bath has less chance to absorb these gases, and therefore the quality of the steel is improved.

The McKune system is said to be adaptable to the use of oil, tar or natural gas without alteration of the furnace as equipped for coke oven gas, except for the insertion of the proper burners. In fact, one furnace has been operated on tar only with an estimated saving of from seven to eight gallons per ton of ingots. The adaptation of the system to producer gas involves complications which have not yet been satisfactorily overcome. Obviously the leaner the fuel, the more necessary it is to provide means for the most rapid and intimate mixture of air and gas possible to insure a maximum flame temperature.

That the McKune system is attracting widespread attention is evidenced by the fact that practically every engineer approached on the subject of metallurgical development has mentioned the method as one of the most important experiments of the year. It is pointed out that one of the limitations to the general adoption of the system, providing it lives up to expectations, is the supply of by-product gas available for open-hearth consumption. In many plants this fuel is employed for heating and power generating purposes. Its diversion to open hearths doubtless will depend upon whether or not the saving effected by the transfer would balance the cost of using other fuels for heat and power.

Powdered Coal as Fuel

Powdered coal is being used in a number of open-hearth furnaces, and many engineers predict that this fuel will be used more extensively until such time as the supply of selected coals is diminished to the point where the cost becomes prohibitive. While the undesirable elements introduced into the bath by the use of powdered

coal constitute the chief objection to the fuel from a metallurgical standpoint, the clogging of the checkers is the basis of complaints from some furnace operators. However, the improved combustion in late installations has gained advocates for this fuel, and at present the tendency is toward the wider application of powdered coal to open hearths. Nevertheless, it never can gain the popularity in this field which it now enjoys in the realm of heating furnaces.

The duplex process has become so firmly established that it cannot be considered an experiment. However, it still is a subject for discussion among the engineers of two factions, who differ widely on the merits of the process. Opposed to those who believe that duplexing is the outgrowth of passion for tonnage regardless of quality, are others who claim numerous advantages for the process, including decreased labor requirements, quality of product, and flexibility. It should be remembered that the duplexing process is most advantageous in plants having large blast furnace capacity, and that its success cannot be judged from the standpoint of its estimated performance in the average steel plant. Undoubtedly there is a tendency toward the extension of duplexing in the steel industry of the United States, and it is practically certain that the operating troubles of the past year have given impetus to the growth of the process.

Size of Open-Hearth Furnaces

A number of open-hearth engineers concur in the belief that stationary furnaces of from 50 to 75-ton capacity now are the American standard for the straight open-hearth process. Regardless of whether this is strictly true, it is a fact that the 60-ton unit seems to be the favorite in large steel plants, while the 100-ton furnace apparently is preferred in small establishments. It is difficult to interpret this preference, unless on the ground that the small producer, seeking economy in labor, realizes that a furnace crew can operate a 100-ton furnace as easily as a 60-ton unit. However, the narrower arches and other construction details make the maintenance of the small furnace less expensive, in proportion to tonnage, than that of the large open hearth.

Large capacity tilting furnaces now are being specified for most of the new installations for duplexing. When this process first was brought to this country from Europe, a number of steelmakers employed stationary open-hearth furnaces, while others used tilting furnaces of 200-ton capacity. The advantages of the latter type, with their deeper baths, doubtless is responsible for the tendency toward their use in projected duplexing plants.

Owing to the impetus given the acid open hearth during the war, the production of this class of steel was abnormally high in 1919. The numerous interruptions to plant operations in 1920 make it difficult to determine whether acid steel is gaining or losing its relative position among other grades of steel. However, the advantages of the acid open-hearth product have been reviewed with unusual frequency during 1920, indicating that the process is likely to be retained for steel for certain products whose specifications conform approximately to those of gun forgings.

Frenzied Steelmaking

RECENTLY an open-hearth engineer in commenting on present tendencies in metallurgical practice, declared that in certain instances, operators are placing too much emphasis upon the importance of production and are disregarding to too great an extent the quality of the product. He cited as an illustration of this passion for tonnage a case wherein the charge in a 90-ton open-hearth furnace was melted down in 35 minutes. Discussing the consequences of driving a furnace at this rate, he said:

"Steelmakers who seek to break production records by such methods are helping to discredit American steelmaking practice. Materials subjected to the action of the open-hearth for so brief a period cannot respond to the necessary chemical reactions, to say nothing of the mechanical treatment they should receive.

"I asked the superintendent if he considers quality in melting a charge in 35 minutes. He dismissed the question with the remark that the steel 'meets the specifications'."

For many years Europeans have criticized American practice on the score that quality is subordinated to quantity. As a general rule this attack is not justified, but the frequent repetition of frenzied furnace operation, as illustrated above will tend to add weight to the charges from contemporary steelmakers abroad.

Use of Electric Furnaces

While the introduction of electric furnaces in the steelworks of the country is lagging behind the installations in foundries and electrochemical plants, the tendency toward the general use of electric steel for certain parts for automotive equipment is well established. Electric melting has supplanted the crucible process in many plants, and is especially favored by the producers of alloy steels.

Several attempts are being made to employ electric furnaces of large capacity with open-hearth or bessemer units in some modification of the duplex process.

Treating Steel in Ladle

A review of the metallurgical development in steelmaking during 1920 would not be complete without mention of the efforts that are being made by a number of inventors to devise a method of purifying steel by supplementary refining in the ladle, either before or after the metal goes through the open-hearth process. One engineer who has been active in investigating the possibilities in this direction, proposes a method whereby air is blown into the steel from below the surface of the bath while the metal is in the ladle preparatory to being charged into the open hearth. He expects to accomplish this by a blast apparatus supported from an overhead crane which can be lowered into the metal in a ladle car. He claims that the preliminary refining resulting from this treatment would be equivalent in its effect upon the product to the action now afforded by the duplex process, in which the open-hearth and bessemer processes are combined. The idea of introducing air to hot metal from below the surface is not new, but inasmuch as the proposed method outlined above has never been given an actual test, it is difficult to determine whether the old difficulties have been overcome.

During the year considerable stress was placed upon the importance of delivering clean metal to the molds after it leaves the melting furnace. One metallurgist suggests that the liquid can be purified by providing a strainer in the ladle by which light and foreign particles can either be checked from flowing into the mold or raked off at the top of the ladle. In the plan proposed, the metal has a horizontal flow from the furnace into the ladle and a vertical flow from the trough to the bottom of the ladle, the metal being stirred in the course of falling. The surface of the trough will have staggered projections which are intended to give the metal a scrubbing action. Another feature of the proposed apparatus for this method is a plug in the lower part of the ladle for controlling the flow of metal to the ingot molds and a device by which the ingot car is locked to the crane supporting the ladle so that both ladle and ingot mold are stationary with re-

spect to one another while the metal is being poured. As in the case of a number of similar inventions, this method has not been tried out in actual practice. It is mentioned here because it indicates that metallurgists are seeking means of obtaining cleaner metal and theoretically, at least have given the problem some attention.

Changes Occur in Foundry Practice

Developments of Past Year Point to Possible Departures from Conventional Practice—Annealing Time for Malleable Castings Is Reduced while Triplex Process Opens Way for Use of Scrap—Try Electric Iron Process

BY H. E. DILLER

RECENT advances in the metallurgical practice of casting plants have been inspired chiefly by the desire for improved castings and by the shifting conditions in the labor, fuel and raw material markets. Perhaps the most notable developments in the past year have been in the field of malleable cast iron, which until a few years ago, lagged behind other branches of the ferrous foundry industry in metallurgical progress.

The most radical change pending in malleable practices, results from the introduction of a tunnel kiln for annealing, which promises to reduce the time for castings to pass through the foundry and to facilitate the production of uniform castings. In the past, annealing practice has been dependent upon the periodic type oven, which necessitates a delay of from seven to eight days or more, between the time the hard castings are cleaned and the date they can be shipped. Although different fuels, such as oil and powdered coal, have been substituted for the original hand-fired coal, the time of the anneal has not been shortened by any of these modifications. The continuous tunnel kiln has demonstrated its ability to shorten the length of time of the anneal, but the full benefit in this direction has not yet been established. Neither will it be until more experience is secured in the operation of the tunnel kiln. Tests have proved that malleable iron can be annealed in a much shorter time than is now found possible in a commercial way, and a wide margin still exists between what has been done and what is indicated as possible in the shortening of the time of the anneal.

Expert Labor Costs Will Be Cut

Besides shortening the length of time of the anneal, it is hoped that the tunnel kiln will decrease the labor costs of charging the castings. This hope is based on the regular flow of castings through the furnace and on the possibility of equipping to efficiently handle the work, as well as on the fact that the castings can be annealed without the use of any packing material. This elimination of packing material also is an aid in economizing on fuel. It is claimed, too, the design of the furnace accomplishes fuel economy due to the hot gases passing through ducts in the furnace and moving the opposite direction from the cold castings as they enter, as well as the precaution taken to preserve the heat by a well insulated roof and side walls. Again the furnace is not cooled as in periodic operation.

A radical departure has been made in the melting and metallurgical treatment of malleable in the new triplex process, by which the metal is melted in a cupola, part of it transferred to a converter and blown to reduce the carbon content, while the remainder is transferred to an electric furnace, which climinates a large percentage of the sulphur, and superheats the metal. When the metal from the converter is added to that in the electric furnace a malleable with a definite carbon content is produced. This process permits the use of malleable scrap, which in the past, has sold at a low price, owing to the lack of demand for it. However, were a number of triplexing plants established, it is a question whether the price of malleable scrap would not rise appreciably and offset some of the advantage of the process. As may be surmised, only a foundry having a large and regular output could efficiently operate such a process.

A tendency to seek a more economical method of melting in malleable practice is noted in the trials made to apply powdered coal to the air furnace. A number of such installations have been made and in some of them considerable experimental work was necessary before the process became satisfactory. One company adapted one of its furnaces to the use of powdered coal and operated it for nearly a year, making several changes in the burner arrangements, before the management felt warranted in changing the other furnace to the new system. The claim is made that less coal is required to melt the metal when used in the powdered form than when hand fired. The elimination of the fireman is also another benefit advanced for the use of powdered coal. Saving of labor in firing the air furnace is also accomplished by a new grate introduced in its foundry by a large manufacturing company. With the use of this grate, the coal is charged into a hopper by a crane and automatically feeds into the firebox of the furnace.

Electric Gray Iron Castings

Extra quality for gray iron castings is being sought through the medium of the electric furnace. A number of plants have been experimenting along this line, but no definite conclusions as to the advantages have generally been accepted. Undoubtedly the amount of sulphur in the iron is decreased, but the degree of advantage of this is differently estimated by various metallurgists. However, the benefit to be derived by the ability to secure almost any desired temperature for pouring the metal is practically universally conceded. Just what position the electric furnace will attain in the ferrous foundry, both as a melting medium and as an adjunct to the cupola, is still undetermined. Arguments are being advanced for the application of the electric furnace to the synthetic production of gray iron and malleable iron from steel scrap, or from combinations of steel and iron scrap, by the addition of carbon silicon.

The electric furnace has extended its hold on the nonferrous foundry industry, a number of rocking and rotating furnaces having gained favor through satisfactory performance. Besides the older types of electric melting furnaces which have advanced their prestige in the nonferrous foundry, a new furnace with what is termed a repelling arc, has been introduced during the past year, but its adaptation so far, has not been general enough to determine its qualifications.

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Industry Prepares To Save Fuel

Review of Recent Progress in Design and Construction of Iron and Steelworks Equipment Reveals Marked Tendency Toward Greater Economy in Use of Fuels — Important Improvements Made in 1920

BY E. L. SHANER

IN ANALYZING the progress made during the past year in the development of equipment for blast furnace, steelmaking and rolling mill equipment, one cannot help but notice that practically every important improvement is in some way related to the problem of fuel economy. This is true not only of the smelting and refining operations, where it would be expected that opportunities of economy in the consumption of fuel are afforded, but also in the finishing of steel where efforts are being made to diminish the work required by rolling, which indirectly affects fuel saving. In fact, regardless of what motive may have prompted the designing engineers in improving the equipment in 1920, the results of their work are bound to be felt in the consumption of fuel during the next few years. If the new equipment brought out in 1920 may be considered typical of that which is to follow in future years, the tendency toward greater efficiency in the use of fuel for iron and steelmaking has become well established in the United States.

One of the best illustrations of the importance ascribed to fuel by the officials of big steel companies is the rapid replacement of old steelworks power plants by modern stations. So pronounced has this practice become that the chief engineer of a company manufacturing electric power plant equipment declared in his annual report for 1920 that the power plants of modern steelworks compare favorably with the large central stations of public service corporations. The superior advantages of large power plants over small isolated plants have long been established and the action of the steel companies in adopting a forward-looking policy in regard to power generating now is bringing credit to the industry at a time when there is agitation for conserving of the nation's fuel resources.

The saving of fuel in the blast furnace, especially during the past year has been a difficult matter on account of the unusual conditions which have obtained in the material and labor markets. If anything, the frequent interruptions to continuous operation have caused an increase in the consumption of coke. However, to balance the losses caused by this abnormal situation are a number of improvements each of which contribute slightly to economy. An effort also has been made to obtain greater value from the coke by

Improvements Keep Pace with Metallurgical Progress

IN AMERICA, where the normal consumption of iron and steel products warrants operation on a quantity basis to a greater extent than in any other country, the development of the industry along technical lines is intimately associated with the evolution of furnace and rolling mill equipment. Sometimes it is difficult to determine whether the advance in iron and steelworks practice precedes the development of the necessary machinery, or vice versa, so closely does progress in one follow that in the other.

Because of this relationship, the characteristics of new blast furnace, steelworks and rolling mill equipment reflect the current trend of effort in iron and steel metallurgy. The engineers who specialize on mechanical and electrical work for the iron and steel industry doubtless have a better general knowledge of tendencies in practice than the operating executives in the plants, in spite of the fact that the latter actually are contributing directly to the crystallization of these tendencies. This apparent inconsistency is not strange because while the plant engineer is familiar with everything transpiring in his own and possibly one or two other establishments, he cannot hope to receive the general knowledge of developments in scores of plants which is afforded the equipment manufacturer's engineer, whose work brings him in consultation with superintendents and plant engineers in all parts of the United States, and in some cases, foreign countries.

Therefore, in collecting the data for the accompanying article, representatives of THE IRON TRADE REVIEW *have interviewed nearly a score of the leading blast furnace, steelworks and rolling mill engineers. Their opinions have been considered in selecting the developments which stand out above the others.*

It is impossible, of course, to draw a sharp line of distinction between tendencies that actually have developed since Jan. 1, 1920 and those which began prior to that date. A number of the important changes mentioned in the article are the outgrowth of ideas conceived years ago, but which did not attract general attention until the past year. There also are important developments, as for instance the application of powdered coal to sheet furnaces, which were attracting attention several years ago but which received such distinction in 1920 by virtue of general adoption, that they warrant special mention now.

rescreening it before it is delivered to the furnace.

Perhaps the opportunities for the study of proper combustion in the open-hearth and other melting furnaces have been especially attractive to engineers; at any rate, considerable progress has been made in adapting various fuels to the open-hearth and to further improving existing equipment so that better control of the temperature is obtained. The more general employment of the powdered coal process in open-hearths and the encouraging results of attempts to use coke oven gas unmixed with other fuels are important developments in this field. Notable advances have been made in the design and construction of burners, mixing valves and controlling apparatus for introducing liquid fuels to open-hearth and other types of furnaces.

In the field of melting and annealing furnaces, a most remarkable bid for favor has been staged by powdered coal. This fuel has practically become standard in all new sheet and tin plate mills and its use in billet heating furnaces, annealing furnaces, etc., seems to be growing steadily. In foundry practice, the traditional method of annealing malleable castings, requiring from six to eight days and involving the tedious process of increasing the original temperature of the furnace to the required point and then cooling and firing up again when a charge has been annealed, seems to be in danger of being superseded by a new method. A tunnel kiln, in which castings may be introduced in annealing pots without packing and in which the furnace temperature is kept constant, even when castings are being charged or taken from the furnace, has been operating successfully for a number of months, apparently reducing the time of annealing.

In the rolling of steel, little has been done to reduce the amount of work required in the various roll passes. This is largely because of the absence of a complete theory of the rolling mill, the design of roll passes being an art instead of an exact science. However, there has been more than usual discussion during the past year on the possibilities of reducing the losses in the roll train. This will not be an easy task. In fact it involves tedious work, much of which could best be performed in an experimental mill. Thus far, the two experimental mills in the United States have not been able to undertake any important work and until they are established on a basis whereby they will be available for extensive research, it will be necessary for rolling mill engineers to continue their investigations under actual operating conditions in the mill.

Second only to fuel as a factor in the design of equipment is labor. Although the United States has always led in the prompt adoption of labor saving machinery, the acute situations encountered in 1920 forced manufacturers who had been backward in installing mechanical aids to seek relief. That an abnormal demand for automatic charging devices, power operated lifts for furnace doors, trucking devices, etc., existed during the year is indicated by the statements of many manufacturers of this equipment who declare that sales exceeded previous records.

The attempt to conserve manpower also is apparent in the handling of fuel and materials. The use of powdered coal in some plants has actually eliminated the use of shovels, while cranes, conveyors, charging machines and manipulating devices for sheets, bars and billets have enabled executives to reduce the number of laborers in mills.

Make Steady Progress in Blast Furnace Design

BLAST furnace design changes slowly and it is doubtful whether spectacular departures from standard design and practice will ever be made. The evolution of a unit of the size of the ordinary blast furnace is based on the slow development of so many details that it is improbable that any important improvements will burst into full bloom suddenly. On this account it is difficult to detect the slight changes in the design and construction of blast furnaces which go to make up a tendency.

Boilers Are Part of Building

In at least one blast furnace power house, engineers have departed sharply from usual practice and have designed the building as an integral part of the boiler setting, rather than erecting a building simply for the purpose of housing the boilers, as is usually the case. In this installation the boilers were riveted into the framework of the building and the stack also was considered part of the structure in the design. It is said that this plant embodies practically all of the features of the most modern power station and doubtless its efficiency will bring the type into further use in the iron and steel industry.

The vast improvements in power house equipment which have been made in blast furnace plants during the past few years have been continued throughout 1920, the trend toward better blowing engines being pronounced each year. Heretofore the advance has been in the design of the boilers, engines and turbines. In the past 12 months, however, power plant engineers in several instances have incorporated central station ideas in blast furnace installations.

In looking over the designs of new stacks built or building in 1920 and comparing them with the plans of similar furnaces built a few years ago, the only noticeable changes are in the size of hearth diameter and the slope of the bosh.

Changes in Furnace Lines

Countless interruptions caused by labor and transportation troubles in 1920, served to emphasize the advantage of steeper bosh angles and wider hearths. On this account it may be said that the tendency in modern design is distinctly toward larger hearths and more vertical bosh lines. The fineness of some of the ores now used also is accentuating the advantage of large hearths with increased batter of the stack lining, shortening of the bosh and increase of the bosh angle. With fine ores this arrangement gives a much smoother operating furnace. This is explained by the theory that the fine ores fill in the spaces be-

tween the coke, therefore causing less contraction in the bulk of the charge at the melting zone than if the ore were present in the form of lumps before melting. A number of furnaces relined to conform with the new lines have benefited from the change and with more furnaces constantly being altered in this manner, it soon should be possible to determine definitely if the tendency will lead to a permanent modification of American blast furnace lines.

More Furnaces Mechanically Filled

American blast furnace operators have recognized for quite a number of years the advantage of mechanical filling and proper stock distribution at furnace tops. However, there are many old furnaces in the country in which the cost of installing modern handling equipment has been considered prohibitive. During the past year, however, because of the serious labor difficulties and perhaps to a lesser extent because of lack of uniformity in the quality of materials, a great many furnacemen turned a mechanical filling and stock distributing for relief. One blast furnace engineer stated that during the past year his company installed more labor saving equipment for blast furnaces than in any previous year.

Again referring to the design of blast furnaces recently built, it is clear that engineers are getting away from the type of skiphoist wherein the bridge was partly supported by the furnace and are designing a structure which is entirely independent of the stack. This is accomplished by an A-frame of structural steel which supports the upper part of the bridge at a point near the top of the furnace. However, none of the weight of the bridge and hoist is carried by the furnace top.

Does Cleanliness Pay?

During the past year comment has been made on several occasions on the unusual cleanliness prevailing at a certain new blast furnace. It was said that at one plant, which began operation in 1920, more than a dozen laborers were engaged daily in the task of keeping the yard clean around the furnace. In the same plant, the elevator leading to the skiphoist motor room would do credit to a fine office building. The hoist motor itself has been covered with 16 coats of paint and is highly polished as the smoothest piece of furniture. The car dumper has been enclosed to keep the coal dust from blowing through the furnace yard and the stoves and stack were undergoing their second coat of paint before they were six months old.

However, the conditions prevailing at this furnace are not typical, because as yet there are few furnacemen who can afford to spend the money on cleanliness that apparently is being spent in the plant cited. However, a fine opportunity is being given to determine the actual money value of a clean plant. In the course of time, if records are accurately kept, one will be able to determine what effect, if any, this unusual expenditure has had upon the cost of maintenance of machinery and repairs to equipment.

More than one blast furnace engineer has stated that the problem of gas cleaning has received unusual attention during 1920. Considerable progress has been made during the past year, both in the dry cleaning and wet cleaning processes, each method being supported by an enthusiastic army of advocates. It often has been stated that the difficulty with wet washers is that the temperature of the gas must be lowered to the temperature of the water in order that the gas may not absorb too much moisture. Dry cleaning, it is claimed, eliminates this waste of heat. Constant improvement has been made in the dry cleaning process and it is understood that tests are being made to improve the method of disposing of the dry dust accumulated from the dry cleaning process. In wet cleaning, important improvements have been made and a thickener has given good results in disposing of the sludge.

In 1919, the first application of the electrical precipitation process to blast furnace gas was made, and last year a second furnace was equipped for this method. As a result of the performance of the first precipitator, it was possible to make a number of changes in the second installation and now, after a period of several months, data are available showing that the improvements have been worth while.

During the year, several noteworthy improvements have been made in the design of electrical precipitators for blast furnaces. First, the intricate insulating arrangement in the first precipitator built has been eliminated and now only three major insulators are used instead of eleven. This reduces the expense for insulators and decreases the number of points of weakness.

The insulator change also has made it possible to build the insulators on the outside of the precipitator shell proper. This places the insulators out of the travel of hot gas and even when the temperatures inside the shell are 1100 degrees, the insulator chamber never exceeds 350 to 400 degrees, at which temperatures porcelain will stand up very well. The difficulties with the first precipitator were largely due to cracking of the insulators because of the high heats. Since making the change, no insulator has cracked because of heat. This has enabled operation to continue for long periods of time without any necessity for cleaning or repairing.

Substitute Small Units for Large

The second important change in the design of electrical precipitators has been the change from large to small units. The large units are replaced by twice as many small ones for a given quantity of gas. Therefore it now is possible to take one off whenever necessary without seriously decreasing the efficiency of the cleaning equipment. At the same time, the smaller units make it possible to have the structural work done in the shop where greater accuracy and care can be used in fabrication in the field.

A minor development which has increased the efficiency of the apparatus and has cut down the amount of attention required for its operation, is the use of independent floor bushing chambers, each of which can be cut off from the flow of gas by means of a small seat valve. This makes it possible to shut off any insulator compartment for cleaning purposes, it being possible to clean off the insulator with a wet rag when it gets dirty. The time required is not over 20 to 30

Making Coke from "Noncoking" Coal

A DEVELOPMENT which if successful will have a direct bearing upon blast furnace operation in certain sections, is in progress at the new plant of the St. Louis Coke & Chemical Co., at Granite City, Ill. It is expected that as the result of research work which has been carried on over a period of many years, the coke ovens installed in connection with the new furnace will produce metallurgical coke from 100 per cent Illinois coal. It is said that the project seems to have every possible advantage making for success and therefore blast furnacemen are awaiting the outcome of the experiment with interest. The successful production of coke from so-called "noncoking" coal would mean an important forward step in the more efficient utilization of the nation's resources, and, of even more importance to the iron and steel industry, it would open the way for the establishment of furnaces and mills in localities which up to the present time have been greatly handicapped by the lack of convenient supplies of coking coal.

minutes and the cleaning periods are about one month apart. Since by the new arrangement, it is not necessary to cut the gas off the cleaner at the time the insulators are being cleaned, the amount of time used for the cleaning operation is extremely small.

It was necessary to clean the insulators on the first precipitator practically every seven days, but the changes made in the insulator compartment eliminate such frequent cleaning and even with ferromanganese gases, cleaning is necessary only about once a month.

The cleaner at Dunbar, Pa., has been operating constantly now since the changes were made some time last year and its service has been continuous. Occasional shutdowns for slight repairs have been necessary but it has been possible to make many of these at the time when the air blast was off.

New Methods of Burning Fuel Attract Attention

FEW important changes have been made in the general design of melting furnaces in a period of many years. In fact, one prominent open-hearth engineer declares that practically the only changes which he has witnessed during his association with the industry for 20 years have been refinements in design, such as the introduction of water-cooled ports, doors, etc. This probably is true even to a greater extent of the charging apparatus for open hearths, which seems to have been so well designed in the early days of its development that engineers of later years have not found cause to change it.

Yet in spite of the claim of technical men who are daily engaged in the study of the design and equipment of melting equipment that "there is nothing new," a casual conversation with any one of them soon develops the fact that they are constantly studying methods of improving equipment and of adapting it to new operating requirements.

The new open-hearth equipment of the past year indicates a tendency toward the selection of units of from 50 to 75-ton capacity for straight open-hearth work. In the case of duplexing, the tilting open hearth of 100-ton or more capacity is the favorite. One manufacturer of open-hearth furnaces declares that the sales record of his company indicates that the 50 or 60-ton stationary furnace is preferred in large steel plants, whereas the 100-ton stationary furnace is usually chosen for plants where operations are on a more modest scale. It is difficult to determine just what this means, although it is quite evident that cost of labor as related to the tonnage produced is a controlling factor.

Fuel and Labor Are Factors

Most of the progress made during the past year in the design and construction of melting equipment can be traced to the effort to conserve fuel and to do away with unnecessary manual labor. Labor-saving devices used in connection with the open hearth, converter and electric furnaces, are not new by any means but the acute labor situation of the past year added impetus to the installation of mechanical aids for handling material.

The experimental work with various fuels for melting stands out prominently in the achievements of the year. The principal open-hearth fuel still is producer gas but the use of powdered coal and coke oven gas mixed with tar is increasing. New installations of powdered coal equipment for open hearths are being made and according to one disinterested authority, will continue to be made in increasing number for some time.

Liquid Fuels in Greater Use

Liquid fuels are being used more and more, probably because of the greater production of tar from by-product and gas producer plants. This latter fuel is introduced into the furnace mixed with air or steam. Some difficulty has been experienced in controlling the supply of liquid fuel to the burner and during the year tests were conducted at one of the plants of the United States Steel Corp. to determine the most efficient method of burning tar in open-hearth furnaces. As a result of this investigation a regulating valve was developed which is said to be capable of controlling the flow of tar or other liquid fuel to an infinitesimal amount. The fuel passes into the valve, down through a stop cock into a trap, then through a triangular opening in the valve seat and hence to the burner. Should any sediment lodge in the opening, it may be removed by closing and opening the valve, the material falling into the trap, which may be cleaned out without interfering with the flow of fuel to the burner. A lock nut is provided for setting the valve for any quantity of fuel.

However, the development now attracting the most attention in the open-hearth field is a new method of burning coke-oven gas, which promises to effect a number of important economies in fuel and furnace costs. The account which follows is from information supplied by the engineering department of the Blaw-Knox Co.

One of the most interesting developments made in open-hearth furnace operation in many years is the McKune system for burning by-product coke oven gas, unmixed with other fuels. The first installation was made in the early part of 1920 at the Hamilton plant of the Steel Co. of Canada, by F. R. McKune, superintendent of the open-hearth department. The results far exceed the early expectations and give promise of very radical changes in open-hearth practice, with a large decrease in fuel and relining costs, and a decided improvement in quality of steel.

In trying to obtain higher flame temperatures in the hearth by change of port design, open-hearth engineers have been confronted by the fact that making the ports small enough to insure proper velocity, mixture and control of the gas and air, would make them entirely too small for carrying the waste gases. Therefore, port designs have been a compromise between the sizes needed for the two different functions the ports have to perform.

Applies Blow Torch Principle

The new system permits the alternate changing of the port areas so as to provide small ports and consequent high velocities on the incoming end and large passages for the outgoing gases. It is virtually the application of the "blow torch" action, to an open-hearth furnace. The combustion in a McKune system furnace is an improvement over standard practice, just as the blow torch is an improvement over an open flame.

The open-hearth furnace using this system at the plant of the Steel Co. of Canada is one of the usual construction for burning producer gas with a normal port. However, a large opening has been cut in the division walls between slag pockets shown on page 21, in each of the four outside or normal air uptakes and above the charging floor level are horizontal water-cooled dampers, capable of entirely closing off the uptakes.

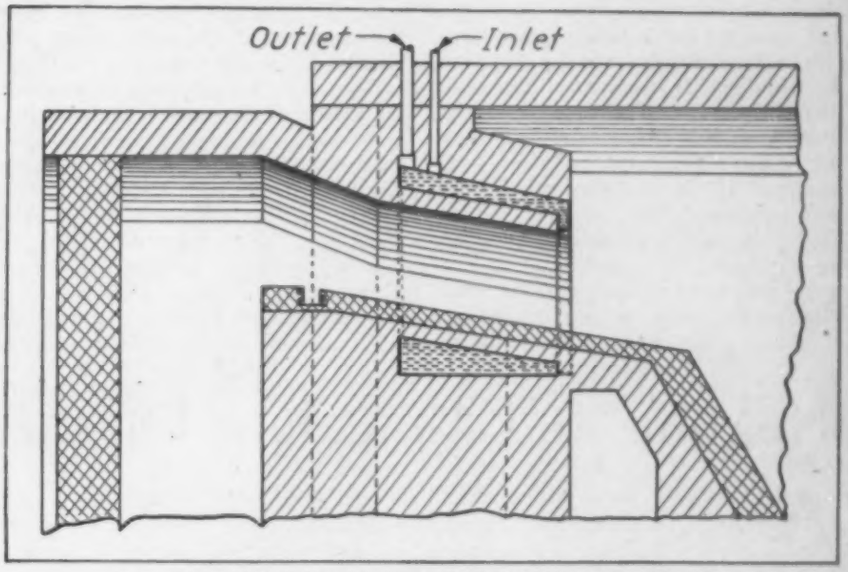
A fan blower is situated on the charging floor above the reversing valves, the air piping from the fan connecting to the inlets of the ordinary gas and air valves. The coke gas is introduced through holes in both sides of and at

right angles to the gas port at a point six feet back of the port nose, the holes leading into a slot four inches square in the floor of the port. This slot is nine inches from the edge of the center uptake.

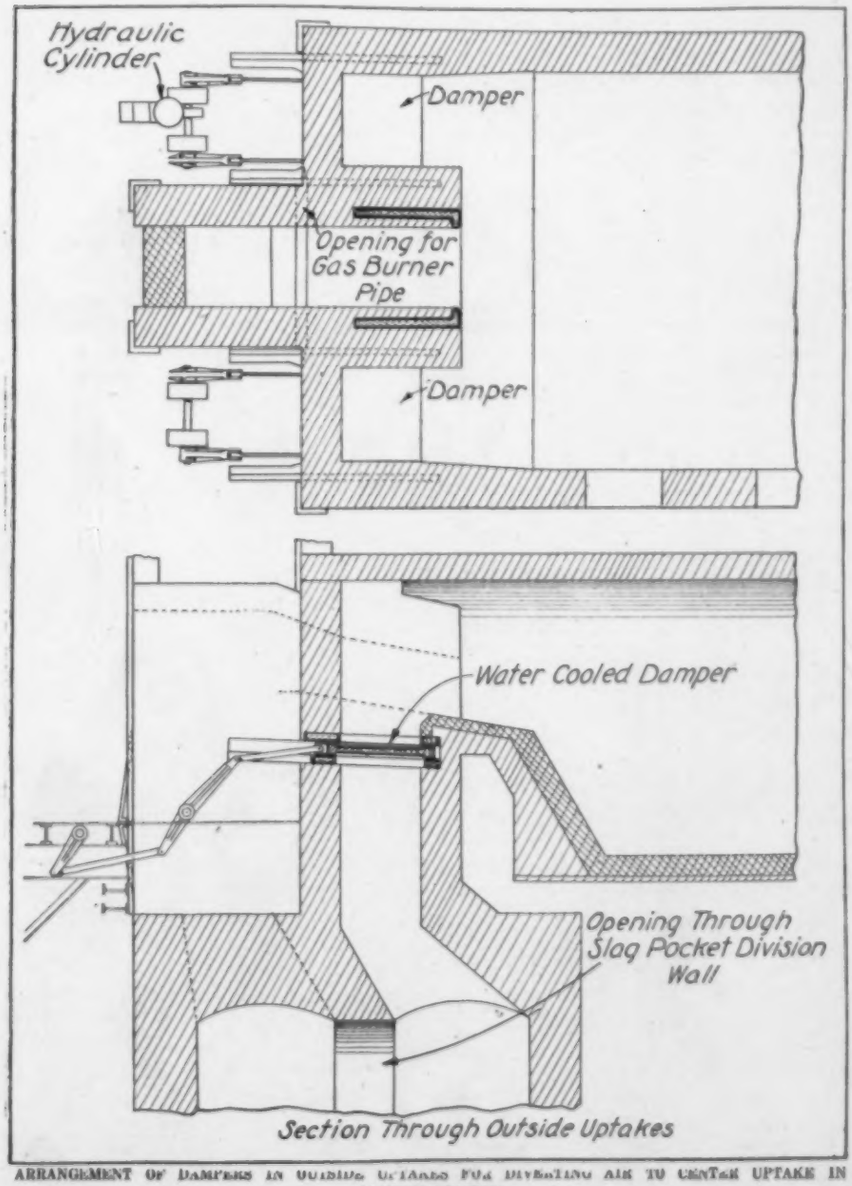
Dampers Control Velocity

When the furnace is in operation, the dampers are closed in the outside uptakes of the end using gas. The air for combustion thus is forced to come through the center uptake, the air from the normal air regenerator being by-passed through the opening in the division wall to the normal gas slag pocket.

The incoming air, being under fan pressure, is driven at high velocity through the relatively small furnace port. The coke gas is delivered through two three inch pipes under eight ounces pressure, and being injected directly into the swift moving stream of air, a thorough and rapid mixture is assured.



THE GAS IS ADMITTED THROUGH AN ORDINARY PRODUCER GAS PORT



ARRANGEMENT OF DAMPERS IN OUTSIDE UPTAKES FOR DIVERTING AIR TO CENTER UPTAKE IN McKUNE SYSTEM

Combustion starts immediately, and when the flame emerges from the nose of the port, it has reached an intensity hitherto unknown in open-hearth practice.

The abnormally high flame temperature is the result not only of the rapid mix of air and fuel, but of the absence of excess air needed for dilution, which would lower the flame tempeature.

Obviously, since all the air and gas travel through a port no larger than a usual producer gas port, the flame must leave the port at an abnormally high velocity. This has two advantages. First it insures high velocity of the flame and burned gases over the bath, a condition of the utmost importance for rapid heat transfer, and second it insures proper control of the flame so that it can be kept on the bath and away from the roof and walls. The flame is necessarily short, scarcely coming to the middle door, and the outgoing ports and downtakes suffer much less abuse than usual.

Large Outlet for Waste Gases

On the outgoing end the dampers are withdrawn from the downtakes, affording three large passages for the travel of waste gases to the slag pockets. The dampers in the uptakes are reversed with the reversal of the furnace valves. It will be seen that while high velocities can be built up on the incoming end by the closing of the uptake dampers, larger and freer outgoing passages can be provided.

The furnace at the Steel Company of Canada, which was the first to be equipped with the McKune system, taps 51 ton heats. A policy was fixed at the outset not to force the furnace above the average production of the plant, but to determine the value of the system from the standpoint of savings in fuel and relining costs. The output of the

furnace averaged somewhat better than the others due partly to less repair delays.

The first campaign was for 447 heats, or about double the normal life under the old practice. The repairs were less than one half what they had been previously. The front and back walls averaged 140 heats. The total relining and repair cost was less than 50 per cent of normal, and came down to the prewar level. When taken off for relining the furnace ends, downtakes and slag pockets were in remarkably good condition, considering the length of the run. The slag pockets had not more than two feet of slag and had not been cleaned during the campaign.

From the standpoint of fuel economy, the results of the campaign were equally gratifying. The fuel consumption was 5,200,000 B.t.u. per ton of ingots. In this figure is included the fuel used in heating up the furnace four different times after it had been shut down for a week or more because of material shortage. Due to certain unusual operating conditions for the whole plant during the past year, it is difficult to judge accurately the fuel saving accomplished, but it is conservatively believed that the McKune system made possible the saving of not less than 30 per cent. Certain it is that the furnace worked absolutely satisfactorily on debenzolized coke oven gas unmixed with other fuels. With an actual fuel consumption of 9647 cubic feet of gas per ton (including heating up) it compares favorably, on coke gas consumption, with the usual practice of furnaces which, in addition to the gas, use 10 to 20 gallons of tar per ton of ingots.

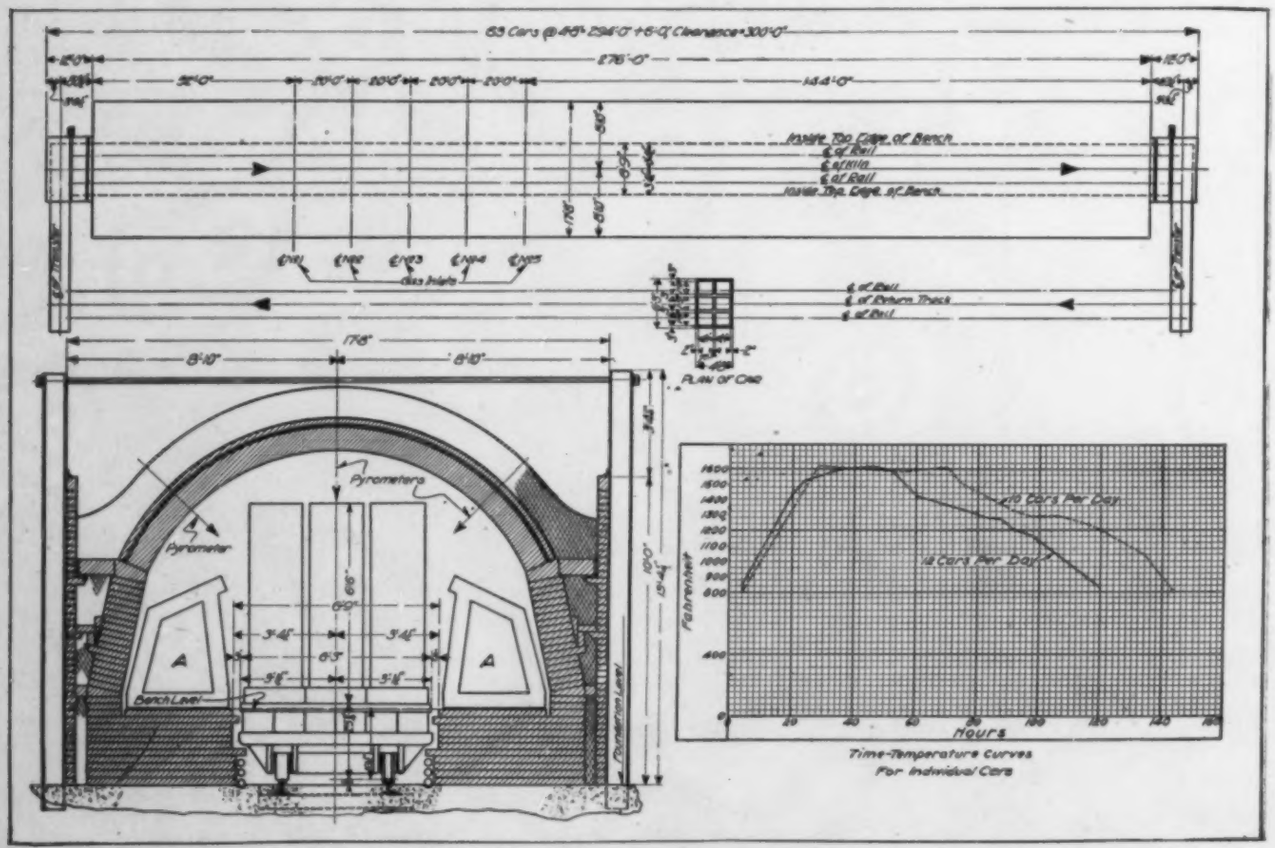
Heating and Annealing Furnaces Are Improved

ALTHOUGH the development of heating and annealing furnaces since the beginning of the world war has been rapid, it is doubtful if the progress made in any one year exceeded that of 1920. Although the hand-fired coal or coke furnaces can be found in some plants, practically all new installations are equipped with labor saving devices and the feeding, stoking or burner arrangement is designed for the efficient consumption of fuel. Perhaps the most active bidder for popularity in the field of heating furnace fuels at the present time is powdered coal. With few exceptions, the sheet and pair furnaces, billet furnaces and annealing furnaces built during the past year have been equipped for powdered fuel.

Automatic Charging Is Popular

Another important development in connection with heating furnaces is the marked tendency toward the universal use of labor-saving charging devices. In the past two years the writer has witnessed few new installations of any kind of heating furnace in which some provision had not been made for automatically handling the product. In most cases this takes the form of a rack equipped with an electrically or hydraulically operated plunger which pushes the charge into the furnace. In many types of furnaces, the hearth is built on an incline or is movable to facilitate the transfer of products from one end of the furnace to another.

Perhaps the greatest departure from conventional furnace practice is the adaptation of the tunnel kiln to the annealing of malleable castings. This type of kiln has been used extensively



ABOVE, THE PLAN OF A CONTINUOUS ANNEALING TUNNEL KILN. TO THE LEFT, BELOW, A CROSS SECTION OF THE KILN. TO THE RIGHT, BELOW, TIME-TEMPERATURE CURVES FOR INDIVIDUAL CARS

in the porcelain industry and to a lesser extent in the steel industry, but the recent installation of a tunnel kiln in a Michigan plant marks the first entrance of this type of unit in the foundry industry.

As shown in the accompanying illustration, the kiln is a long tunnel having two large combustion chambers, *AA*, which carry the burned gases to the exhaust.

A set of burners is on either side of the furnace. The cars enter at the left and travel in the direction indicated by the arrow. A cross section of the furnace is shown in the lower left-hand corner. The combustion chambers are formed by hollow refractory tile placed against each other, making a duct through which the burned gases are carried to the exhaust. As the ducts are hollow with openings at both the lower and upper inside portions the gases of the kiln chamber enter the lower portion of the hollow tile, are heated by contact with the walls and so rise through both the front and back leg of the tile, passing out through the apertures at the top. This action produces a constant circulation of heated gas in the kiln so that the temperature is practically the same at the top of the kiln as it is at the bottom of the kiln.

In the operation of the kiln, castings are packed into pots without packing material. The pots are placed on cars which are charged into the furnace through an antechamber at regular intervals. The cars travel through the kiln in an opposite direction from that in which the gases of combustion are moving, although these gases do not come in direct contact with the cars or their charge. The cars continue on through the firing zone where they attain the maximum temperature. They then pass to a portion of the kiln which is not heated except as to the walls and roof which absorb heat from the hot pots. While passing through this zone the charge is gradually cooled. When the furnace is filled, a car passes out the rear, and each time a new one is charged into the kiln. This outgoing car first enters an antechamber from which it is drawn after the door between the antechamber and the main portion of the kiln is closed to prevent the admission of air into the kiln. The charge comes from the kiln too hot to be handled so it is placed under a pipe through which air is blown on the hot charge until the next car comes from the oven. After the charge is cool enough to handle, the pots are dumped.

The performance of the tunnel kiln is being watched closely by all producers of malleable, because it embodies the first radical departure from practice which has not changed since the days of Seth Boyden.

Attempts to make iron and steel direct from ore have not received as widespread attention in the United States as in Europe where a number of processes for making iron and steel direct from ore are being exploited. It is claimed that several thousand tons of iron have been produced by the Basset process, in which the ore is smelted in a rotating furnace similar to that employed in the manufacture of cement. The ore is charged at the uper end and works its way toward the bottom as the furnace slowly revolves. Pulverized coal is used for fuel and the air which supports combustion is previously heated to about 1000 degrees Cent. in a regenerator.

American engineers will be struck with the similarity between this process and the Jones step process which was the subject of extensive trials at Marquette, Mich., more than 10 years ago.

Seek Economy through Study of Roll Train Losses

BECAUSE greater emphasis has been placed upon the opportunities for economizing in the consumption of fuel for smelting and refining purposes is no reason for believing that similar possibilities do not exist in the rolling of steel. Within the past year an unusual amount of attention has been given to the subject of fuel economy in rolling mill power plants. No doubt the events of the coming year will add impetus to the movement for greater efficiency in this respect, crystallizing the present tendencies into actual achievement.

One of the best analyses of the status of the rolling mill industry in relation to fuel economy is contained in an article prepared by A. Dyckerhoff, electrical engineer, Illinois Steel Co., South Chicago, Ill., for publication in an early issue of THE IRON TRADE REVIEW. The writer's opinion regarding the importance of the subject is indicated by the following abstract:

Economy of Fuel Is Problem

"There is scarcely any other embodiment of energy more sought for today than coal. The spirit of saving fuel in one form or another has animated mill engineers during the past few years. Steam of higher pressure and superheat is being applied more and more. Engineers take advantage of economizers; keep the setting of boilers as tight as possible; try to do away with leaks, etc., endeavor to run reciprocating gas and steam units at the best possible economy by frequent indicating and valve setting; and keep a careful record of fuel, water, etc., used.

"However, little positive improvement has been made in the energy required directly by roll trains. The roll designer has no regard as to the requirements of work, momentary or average, by the rolls and allows the mill engineer to adapt the driving unit to the trains. Naturally under such conditions, there is no economy, at least on the roll trains. With the most efficient driving units steam or electric, the endeavor for complete recovery is not carried through to the rolls and to some extent is made futile.

"Actual operating data reveal the importance of this question. The percentages shown in the accompanying table are based on the average energy in British thermal units per ton of finished product covering a period of a year. These figures show that the electric drive holds its economic superiority in spite of the improvements made in the steam engine and boiler practice under equally modern conditions.

"Another opportunity for improvement lies in the greater roll train economy. The friction load of two light rail mills of identical design differs by from 70 to 80 per cent and on two reversing mills the work for rolling differs 15 per cent for the same elongation and for the same mill diameter and ingot weight.

Must Reduce Work of Rolling

"In order to economize roll trains the work of rolling must be reduced. This means improvement in roll pass design. In a large plant this will involve extensive work and can be accomplished only by the tedious study of numerous passes. With a more thorough knowledge of the maximum efforts and their reduction the maximum demands on the power house will be lowered, improving the load factor. Moreover, roll breakage and trouble with babbitt will be diminished and the quality of the finished product will be improved."

Another authority who deplores the present status of the theory of the rolling mill is W. Trinks, professor of mechanical engineering, Carnegie Institute of Technology, Pittsburgh. In a paper read before a meeting of the Association of Iron and Steel Electrical Engineers, he attributes the absence of articles on rolling mills to the fact that engineers have hesitated to admit how little the profession really knows about the theory of the rolling mill. Referring to the factors

Efficiency of Roll Trains with Steam and Electric Drive

Type of Mill	Driven by	Efficiency Power Plant	LOSSES IN PER CENT: Fuel	Boiler Losses	Losses in Electric Power Plant	Losses in Steam Engine and Line	Lines Losses	Losses in Fly-wheel Set	Friction losses in Mill and Engine	Losses in Electric motor and in friction of Mill	Effective for Rolling
40-inch reversing blooming mill	Simple twin engine	...	100	40	....	56.73	....	....	0.41	....	2.86
40-inch reversing blooming mill	Twin tandem compound condensing engine	...	100	30	....	62.30	....	....	1.15	....	6.55
40-inch reversing blooming mill	Electric motor	9.00	100	..	91.00	....	0.21	3.26	....	0.78	4.75
40-inch reversing blooming mill	Electric motor	17.25	100	..	82.75	....	0.355	5.92	....	1.575	9.40
40-inch reversing blooming mill	Electric motor	22.00	100	..	78.00	....	0.45	7.55	....	2.05	11.95
Continuous light structural mill	Electric motor	9.00	100	..	91.00	....	0.21	1.03*	....	3.11	4.65
Continuous light structural mill	Electric motor	17.25	100	..	82.75	....	0.34	1.71*	....	6.10	9.10
Continuous light structural mill	Electric motor	22.00	100	..	78.00	....	0.44	2.19*	....	7.80	11.57
Continuous light structural mill	Uniflow engine	....	100	30	....	59.90	....	....	3.70	....	6.40

*Motor and secondary electrical losses.

governing roll train economy, he seconds Mr. Dyckerhoff's contention when he writes:

"Roll pass design—the shaping of grooves which give the desired deformation—is not an exact science, but an art. The roller, the roll turner, and sometimes the roll draftsman watch the deformation caused by existing roll passes, and design new ones, more or less instinctively on the basis of the existing ones. The uncertainty grows in direct proportion to the departure of the new design from the old one. There are few men in the world today who can design a roll pass for a new shape (which has never been rolled before) on the basis of first principles.

"Plastic flow of steel in the roll pass is a fascinating study in which very little can be learned from the shape of the entering bar and from the shape of the delivered bar. The piece to study is not the finished product, but the spoiled piece, which is called a cobble. The piece which stuck in the rolls contains all of the transition stages from the entering shape to the final shape and reveals the mysteries of the flow of steel better than any other. It has been said that good roll pass designers frequent the cobble pile. The cobbles which were accidentally made in commercial mills, must be used with caution, because the sustained pressure of the rolls changes the deformation from what it would have been, if the roll pressure could have been removed at once after the sticking of the bar in the rolls.

"What we need is a series of methodically planned tests in which cobbles are made systematically and in which the deformations are carefully analyzed."

Direct Versus Gear Connection

In studying tendencies in the design of rolling mill equipment, one inevitably is confronted by the relative merits of electric, gas and steam drive. When asked if he thinks the tendency is toward a complete and early replacement of steam by electric drive, one well-known rolling mill engineer answered, "In old plants, no, in new plants, yes." Of the 23 plants now under construction by one firm, all are equipped with electric drive; nevertheless the gas and steam engines built during the past five years have shown such remarkable efficiency that mills driven by these units are reliable, successful plants.

During the past year there has been much discussion on the relative advantages of large direct connected and small gear connected motors. Undoubtedly the present tendency is toward high-speed motors and gears in continuous roll construction. Many engineers feel that wherever 25-cycle current is available, the direct connected, slow speed motor has the advantage because of greater simplicity. With 60-cycle current, the construction of slow speed motors required in rolling mill work becomes a problem because the number of poles necessary and the resultant exceedingly large diameters. Each of the two leading manufacturers of electrical equipment have built motors of this type and despite their unusual size and high cost, they seem to operate satisfactorily and have the advantage of unusual simplicity.

One of the complications attending the use of direct or gear connected motors for certain types of mills is the difficulty of protecting the windings from the dust and dirt of the mill atmosphere. This is an important consideration in sheet and tin mills where the ventilating air carries a great amount of foreign matter into contact with the driving motor. Except in cases where the rope drive is employed, the motor is mounted in a pit between two hot mills. Here it is exposed to hot neck grease, coal dust, steam, iron oxide and dirt which settles in the recesses of the motor and in time seriously interferes with its operation.

In an attempt to remedy this difficulty, several mill engineers have enclosed the motor, gears and oiling system in a protecting structure of sheet iron on a steel framework, clean air being supplied from outside the mill by a fan. It is important, in housing the motor in this manner, to provide for easy access to the motor parts.

Another favorite point for discussion in the design of mills connected to the same motor, and this applies particularly to sheet mills, is the proper method of absorbing the backlash. In the majority of plants, a mechanical brake, usually consisting of two heavy wooden blocks, is clamped over the extreme end of the last mill, but in at least one case an attempt has been made to utilize the power lost in the backlash by connecting a generator to the last mill. This unit has not been in operation long enough to warrant conclusions as to its success.

The Status of Continuous Mills

Last summer a French engineer visiting in the United States made inquiries regarding the rolling of sheets or tin plate in continuous mills. Although the application of the continuous process to these products is not considered impossible, little has been done in this country in this direction. One authority doubts if tin plate rolled in this manner would prove satisfactory, even if continuous rolling should become commercially possible.

From time to time engineers have raised the question of changing blooming mills to the continuous type. As in the former case, the idea is not considered incompatible with engineering skill, but it is not expected that the application will be made for years to come.

However, the tendency toward the more general use of continuous mills for work in which they have already proved successful is well established, and rapid strides in their further development undoubtedly will be made. A new departure in the application of electric drive for a two-high bar mill is now being made in one plant where reversing equipment is being installed for the first time on this type of mill.

Engineer Is Business Missionary

American Engineers Form Connections That Bring World Trade to American Industries—Financial Support of Engineers in Developing Foreign Resources Would Assume Rapid Growth of Export Trade

BY E. C. KREUTZBERG

A NATIONAL export policy is needed to safeguard and promote the prosperity of the United States. Productive capacity in many lines of industry here has increased in the past few years to an extent that necessitates the development and retention of foreign outlets on a large scale if our plants and workers are to be kept busy. To do business abroad, now that normal conditions are returning throughout most of the world, it is essential to bear in mind that something other than the mere desire to sell is required of our merchants and manufacturers. A review of the various factors that have a bearing on the building up of foreign trade is apropos at this time, since Americans are beginning to form some definite impressions as to the lines which foreign buying in our markets will follow during the next few years.

The bewildering demand from all quarters of the globe during the war was followed by a period of confusion in which a great many projects were visualized in all countries. Uncertainty as to impending financial and political developments prevented the realization of all but a very few of them. Sufficient time now has elapsed since the armistice to enable business men of all countries to catch their breath, and to form some definite plans for the future.

When deflation has run its course these plans will result in world wide business on an unprecedented scale, and the extent to which we share in it will be determined entirely by the extent to which we understand and dispose of the factors involved.

America Gains During War

The grand scale on which American products found their way into all foreign countries during the war gave to us an unexampled industrial and engineering prestige. For one thing, it brought to our shores a tidal wave of foreign commissions, manufacturers and engineers, and it brought to us a great many inquiries from all over the world. While a good reputation undoubtedly is a big asset in doing business, the interest manifested in our products and our methods must not be misunderstood. It rapidly is becoming apparent that what is chiefly involved in this interest from abroad is a desire to adopt our methods where they can be applied and to copy rather than buy our products.

Those Americans who have been abroad to study conditions and opportunities for business, are agreed that there is going to be a continuation of the world-wide demand for certain kinds of American labor-saving equipment, and here will continue to be a good field abroad for certain specialties in which our manufacturers are pre-eminent.

Foreign Sales Hinge on Investments

But they say that the volume of foreign sales of our products generally will be governed almost entirely by the extent to which this country as a whole learns to invest abroad, and to become international-minded, and, in this direction lies the greatest obstacle. The dearth of foreign listings on the New York stock exchange, as compared with the abundance of them in the London list, illustrates a fundamental condition which must be changed before the United States assumes the place in the world's trade to which merit entitles it. The average English investor has just as much confidence in Zambesi rails as in the Manchester ship canal. American investors must be taught to have just as much confidence in the sound securities of a railroad in China or a power project in Brazil as they have in the shares of any sound enterprise in this country.

Possibly the apathy of Americans with respect to foreign securities is due to a considerable extent to the previous lack of machinery for facilitating foreign investments.

The big factor in England's preeminence in foreign trade has been the employment of so-called investment trusts whose function has been the promotion of investments in foreign undertakings. Americans were slow in adopting this principle and only recently the first adaptation of it took the form of the Edge law, under which so-called Edge banks are allowed to issue certificates to raise funds with which to buy instruments of debt of foreigners. While Edge banks will constitute a vehicle for financing foreign enterprises, the Edge law did not create the will to invest abroad. There is a sound basis for believing, however, that the creation of an instrument by which foreign investments readily may be made will result in popularizing such investments. In fact, the last bulletin of the First Federal Foreign Banking association, the first bank established under the Edge law, asserts that real progress and development are going on in our export trade.

Past experience has shown that as a developer of foreign demand for American products, the American engineer takes first rank. When an American engineer gains a foothold abroad, there begins at once a never-ending stream of orders for American products.

In this connection the subject of foreign investments assumes vital importance, for the employment of American engineers abroad hinges not only on their technical qualifications, but on their ability to organize and finance the projects they are called upon to carry out.

Obtains Contracts in Brazil

Recently Corning & Co., New York, took a contract for what is to be the first complete steel plant in Brazil. This plant will consist of electric furnaces for producing pig iron, and of a steel works for rolling bar mill products. It also will include a foundry. Years ago, Dr. F. S. Pearson, the distinguished New York and Canadian engineer, who sank with the Lusitania, was approached by a native of Brazil who had certain concessions that he was unable to handle himself. Dr. Pearson went to Brazil and in the succeeding years there sprang into existence at Rio de Janeiro, Sao Paulo and other Brazilian cities various public service enterprises which were organized, financed and built by or through him. In charge of one of these enterprises, the Sao Paulo Electric Light & Power Co., is W. G. McConnell, an American engineer. Mr. McConnell's son, Murray McConnell, was vice president of Corning & Co. at the time the contract was booked, and it was the knowledge

of Brazil and the acquaintance that his residence there gave him, that resulted in the closing of this business.

Thus is afforded a striking example of the extent to which business begets business in foreign fields.

And, in view of the fact that production of pig iron and steel by electricity is particularly adaptable in a country like Brazil where rich iron ore and water power are abundant, but where there is no coking coal, it seems logical to assume that Corning & Co.'s contract paves the way for other developments of this character.

China—Land of Opportunity

China, with 400,000,000 people and tremendous resources in the way of raw materials, has only 6600 miles of railway. For developing the country, railway building on a huge scale is essential. This work will be done not by the countries that are willing to do it, but by those able and willing to organize and finance it. In 1916, W. F. Carvey, president of the Siems-Cary railroad & Canal Corp., New York, secured from the Chinese government a contract for the construction of 1100 miles of railroad with an option of an additional 1500 miles. At the same time, he booked a contract for the construction of a canal to serve for irrigation as well as transportation purposes. These contracts provided not only for the actual construction work but also for its organization and financing. Execution of these contracts has been retarded, pending the materialization of more favorable financial and other conditions than those prevailing as a result of the war, but, based on experience in other cases, it is hoped that they will prove to be the entering wedge for American participation on a large scale in railway building and other development work in China, with resulting demand for numerous kinds of American products.

In this connection it is timely to dwell upon the importance of securing recognition of American standards abroad. The extent to which foreigners during the war accepted materials to American Society for Testing Materials and other American specifications may not be taken to indicate that foreign buyers generally will continue to buy American standards. As a matter of fact, most of them prefer their own standards and only accepted our own during the war by reason of inability to place orders otherwise. Now that materials are easier to get, the majority of foreign buyers may be expected to specify as before the war. American inspection engineers, however, say there are some very decided exceptions, and one well-known engineer goes so far as to say that about 20 per cent of the foreign buyers are highly pleased with American specifications and will continue to order materials to these specifications. This figure, of course, represents a decided increase over the percentage that specified American standards before the war.

The important thing with reference to specifications is to stimulate interest in American standards in the countries that have not yet thoroughly developed standards of their own. In Peking, last June, there was held an engineering conference to decide on standards to be specified for Chinese railroad equipment. Despite opposition from British engineers, the American 33-inch standard car wheel was accepted by the Chinese as standard after the French representative at the meeting stated that France, due to her experience with American railroad equipment during the war had adopted the 33-inch wheel. Another standard adopted at the June meeting was the Westinghouse type of air brake. Standards for other equipment were left for later discussion.

The significance of these developments in China becomes apparent when it is realized that American manufacturers are likely to obtain more business from China if American, rather than European standards prevail there.

An energetic American policy with respect to railway projects in foreign countries, is extremely desirable in view of the magnitude of this field. Of approximately 2000 foreign propositions that were submitted during the past three years to one great American corporation, some 300 were concerned directly with transportation, while the others involved everything else under the sun. This corporation takes the attitude that of the work to come up abroad in the next few years, 50 per cent is likely to be connected with transportation. The desirability of an energetic American policy in this direction may be emphasized by reason of the belief in authoritative quarters that American engineers are pre-eminent in railway work and understand better than engineers of other nationalities the art of adapting the railroad to the work it is to do.

America Must Furnish Capital

The important thing about this railroad construction abroad is that it will require a national will to do it. For our engineers to build railroads abroad, it will be necessary for the American public to develop large capacity for absorbing the stocks and bonds of these roads.

There are certain lines in which the pre-eminence of American engineers has enabled them to develop foreign resources without the necessity of attending to the finances. These activities, too, have been characterized by steady buying of American products on a large scale. A notable example is the identification of C. P. Perin with the development of the iron and steel industry in India, which dates back to 1902, when the late Jamshedji N. Tata visited this country. The plant of the resulting Tata Iron & Steel Co. represented an investment of $20,000,000 and extensions now being made involve an outlay of an additional $50,000,000. Not only are Mr. Perin's efforts to provide the most efficient apparatus resulting in a steady stream of orders for American equipment for this great and expanding plant, but this stream promises to continue by reason of the fact that Mr. Perin's work in India is embracing the development of that country's resources on an expanding scale.

It is worth while to summarize the work which Mr. Perin has under way in India or which is scheduled for early execution. He and his associates have designed and are erecting a 60-ton charcoal furnace for the state of Mysore; it is to have full wood alcohol and acetic acid by-product recovery. They just have started construcion at Jamshedpur of a plant for

Is European Engineer Better Educated?

A PROMINENT American engineer recently made the following statement regarding the personnel of the American engineering profession as compared with that of Europe:

"The average American engineer is technically able but not well educated. He is little better than a high grade mechanic. The average European engineer has technical training and a general education which would bring him a doctor's degree over here. Despite this, he works for less money than the American. What the American engineer needs to compete successfully against the European engineer is not only a thorougth technical training, but if possible, a knowledge of foreign tongues, the ability to show off to advantage in a frock coat and proper clothes, and the savoir faire which will enable him to associate with bankers, presidents and even kings. While a knowledge of foreign languages is not essential, it is of great assistance, and where only one tongue is selected, French, perhaps, proves most useful."

the Tin Plate Co. of India. This will have initial capacity for 30,000 tons a year, which later will be increased to 120,000 tons a year. They are erecting for the Dwarka Cement Co., a cement plant to have a capacity for 2000 barrels a day. They will erect for the Jubbulpore Cement Co., a cement plant with capacity for 1000 barrels a day. In addition, plants for two other companies, each having a capacity for 2000 barrels a day, are under contemplation. Work just has been begun on the construction of a metal shelving plant and a wire mill for the Indian Steel Wire Products, Ltd. Work is about to be started on a plant for the Agricultural Implements Co., Ltd., of India, which will manufacture picks, hose, mattocks and other agricultural implements used in that country. Among other activities, Mr. Perin now has a geologist at work on a survey of the mineral deposits of the state of Hyderabad. In addition to Mr. Perin's activities in India, other American engineers now are extensively engaged in developing that country's resources.

China Adopts Western Ideas

The pre-eminence of the American iron and steel industry not only has led to the patterning of the Indian industry after American methods but also is gaining a firm foothold in China. One of the most notable examples is the blast furnace having a capacity for 100 tons of pig iron per day, which was erected for the Yangste Engineering Works by Mr. Perin and his associates, who also are erecting an even larger unit for the Lunyen Mining Administration.

In Spain, Frank C. Roberts is building what ultimately will be the huge plant of the Compania Siderurgica del Meditteraneo, at Sagunto on the Meditteranean coast, 14 miles from Valencia. This plant, which obtains its iron ore from mines once worked by Hannibal, so far has been provided largely with American equipment. The plant which is expected to be completed in about three years, will have a capacity for producing approximately 1000 tons of rails, shapes, bars, plates and other finished steel products per day. The extent to which American equipment will be installed in the future will depend largely on developments in the exchange market.

American steelmaking methods have become practically the standard of the world. One European manufacturer, in fact, now is advertising that he is in the market for orders for rolling mills of a well-known American type which have been sold extensively abroad. The Japanese iron and steel industry is being modeled in accordance with American methods, and huge shipments of American equipment have been made to that country. The Morgan Engineering Co. early this year shipped to the Imperial Steel Works, a 180-inch plate mill, the largest ever built for export. Big orders for steel works equipment have come from England, France, Belgium and other countries. Orders from abroad for equipment of this character have fallen off lately only in proportion to the general lull in world wide business. The Wellman-Seaver-Morgan Co., Cleveland, has orders for open-hearth equipment for Japan.

An important development which promises the early undertaking of iron and steel production in Brazil, based on imported coal as a fuel, is a concession signed recently authorizing the Itabira Iron Ore Co., Ltd., to construct a by-product coke plant, blast furnaces, steel works and two railroads. Promoting this enterprise is Percival Farquhar, an American engineer, who controls the Itabira company. Plans for this plant call for a comprehensive outlay as described on page 164 of THE IRON TRADE REVIEW of July 15, 1920.

An interesting instance where American engineers have taken a contract for blast furnace construction in Europe in competition with European engineers, is that involving two stacks to be erected in Holland, for the Royal Netherlands Blast Furnace & Steel Works Co. The decision to erect the furnaces followed Holland's determination to assure herself of a pig iron supply, and followed from the scarcity of this commodity in that country during the war. The American engineers, Freyn-Brassert & Co., took the contract largely on superiority of design, since their plans called for only about 2700 tons of steel. Furnaces of the heavy construction prevalent in Luxemberg and Lorraine would have required about 4800 tons of steel. Plans for the latter type would have provided enormous bins, with four tracks for the ore and coke cars, while the buckets were to have carried 11 tons and the skip hoists and top work would have been far heavier than found necessary in this country.

Demands upon American engineers in the lines in which they are pre-eminent throughout the world is not repeated from Europe, however, to the same extent as from less developed countries. For instance, in England, American iron making practice first gained ascendancy at the beginning of the twentieth century. At that time, Mr. Roberts built two modern blast furnaces for Bolckow-Vaughn & Co., followed by a complete blast furnace plant for the Frodingham Iron & Steel Co., and a Gayley dry-blast equipment for Guest, Keen & Nettlefolds, Ltd. It is of interest to note that these installations marked the general recognition by the iron industry of Great Britain of American methods, as compared with German methods.

The significant thing about the latter installations, is that, with their erection, the British industry no longer is calling on American engineers for duplication of such plants, but is itself attending to the construction of additional units of similar type.

Labor Saving Abroad

American engineers who have investigated foreign possibilities from the American standpoint, declare that the chief demand from Europe, with the exception of Russia, the Balkans, Spain and Italy, will involve labor-saving equipment. This does not mean that all kinds of labor saving equipment will be welcomed. For instance, an American engineer who recently visited a hydroelectric construction job in Italy found there was not a single piece of construction machinery. All the work was being done by hand. Rocks weighing as much as 600 pounds each, were being taken to the site on wooden platforms carried by laborers, one at each corner. The cost, however, proving to be less than if American methods had been adopted.

Several prominent engineers declare that labor saving equipment is not desired in most European countries, on the ground that what is needed most is work for the people.

It seems quite logical, however, to assume that Europeans can be expected to buy our equipment when it cuts their costs. The Niles-Bement-Pond Co., for instance, sold three driving wheel lathes which supplanted 15 machines of English design in an English railroad shop. Recently this company secured an order for 21 of these machines for the Paris & Orleans railway, making certain changes in construction to accommodate the French wheels.

For certain kinds of American labor-saving equipment, in fact, there are no geographical or political limitations and questions of organization and financing scarcely can be involved.

A good example of such special equipment is the rifle making machin-

ery produced by the Pratt & Whitney Co. This company sold a complete rifle plant to Australia which is producing 50 rifles per day with just about half the number of machines that would have been necessary with equipment of European design. The Pratt & Whitney Co.'s pre-eminence in this line in recent years also has brought orders for complete rifle plants from China, Chile, Russia, Spain and Serbia, although due to conditions during and since the war, some of these plants have not been shipped.

Russia Will Come Back

American engineers who think internationally declare that our present best fields for foreign business are South America, Spain, Mexico and Central America. They regard Russia as a field pregnant with promise when conditions in that country permit normal development, and Siberia, a great country having essentially the same character as Canada, as inevitably linked with the future of Russia. China they look upon as a field for great development. They point out that the difficulty encountered there is the exploitation and grabbing by European powers and the lack of a stable and satisfactory policy on the part of the United States government with respect to China. Italy, Spain and the Balkans they regard as good fields for business financed by American capital. Africa is regarded as a field of promise for this country to the extent that American capital is invested there. Australia's markets are regarded as being chiefly under the domination of Europe as far as general foreign trade is concerned.

In South America, Mexico and Central America there is a feeling of friendship toward the United States. Engineers familiar with conditions in these countries say that they need our products and our ability but that the development of new business there will be slow because their inhabitants in many cases are slow in realizing how much progress there is for them to make. In developing business in these countries the necessity for financing the projects undertaken will continue to be an important factor.

When the American International Corp., for instance, constructed the sewers and water systems in three cities of Uruguay, this corporation not only did the work, but had to finance it. Water and sewer systems, sanitation projects, and other public service developments in those countries will continue to afford great opportunities to Americans to the extent, largely, that they are willing to finance them.

An instance of business obtained under novel circumstances is that involved in the railroad shops recently completed for the government of Chile. For many years the Chilean state railways found themselves badly handicapped by the lack of proper shops, and as their lines grew in importance, the lack of adequate repair facilities was the principal source of an increasing and disproportionate cost in operating expenses. In 1913, the Chilean government announced a contest and invited the leading engineers in Europe and the United States to prepare plans, specifications and estimates for a complete general repair shop having an approximate capacity for repairing 500 locomotives a year and a corresponding number of passenger and freight cars. The successful contestant was the Niles-Bement-Pond Co., which was awarded the first prize of $20,000, while the second prize was divided equally between a Belgian and an English interest. In addition to the first prize, this company later received an order for all of the machinery and cranes for this plant. The latter since has been completed and is not only the most complete and modern establishment of its kind in South America, but compares with the best in the United States. Its completion greatly has increased American prestige in this kind of work in South America.

While foreign business is created in various ways, a large share of it has sprung from ideas originally conceived by engineers engaged in activities abroad. For instance, a distinguished American engineer while the guest recently of some Argentine public officials, took the opportunity to map out a program which would yield them good roads whose serviceability amply would justify the expenditure involved. It is too early to know whether his remarks will bear fruit, but it is certain that they made an impression at the time, due to the fact that many South America, but compares with the cepted bad roads as one of their inescapable tribulations. This is but one of hundreds of instances of the value of the American engineer as a business getter abroad.

In addition to the iron and steel, railroad and general labor-saving machinery branches, American engineers are preemnient in pipe line and oil development work. In mining enterprises they are in the front rank, as attested by the international fame of such figures as John Hays Hammond and Herbert Hoover. They are preminent in electric power developments, excepting that Italian engineers have constructed hydroelectric plants with much greater heads than those attempted by our engineers. Pressures of 3000 feet are common in Italy, while one with a 4800-foot head now is being planned.

Since engineers are of such prime importance in the upbuilding of this country's business, it is well to point out that with the exception of a comparatively small percentage, the profession here, from the standpoint of education, training and ability, compares unfavorably with that of some other highly developed countries. Leading American engineers have no hesitancy in stating this to be the case.

Immediately after the war, as everyone knows, there was a counterpart to the invasion of foreign visitors here in the form of an aggressive effort to cash in on the extent to which the prestige of American engineering and industrial methods had grown abroad. American engineers and business missionaries visited Europe, South America, China, Japan and all portions of the world. While there were exceptions, their errands as a rule terminated in disappointment.

One disappointment, for instance, was the lack of enthusiasm shown for them in France, a country which they had expected would receive them with open arms. A good many American engineers during the war had visions of establishing themselves there in business, but practically all of them now are back in the United States. France has ideas of her own and relies on herself.

Public Must Buy Foreign Securities

Clearly, the solution in our quest for foreign trade, for the foreign outlets that we meet have to keep our increased manufacturing capacity occupied and to establish our prosperity on a firm basis, is to take a page out of England's book over the last 400 years. In other words, our investing public must be taught the habit of buying foreign securities.

Summarizing the observation of our engineers and business missionaries, they found, first, that enterprise was being held up by the world-wide state of uncertainty. Secondly, they found that, with exceptions, the world was desirous of copying rather than buying our products. Thirdly, they found that this country possesses no monopoly on engineering ability.

The most important fact they discovered was that the world needs a great deal of money and that the nation that supplies the money will receive the business.

Plant Expansion in 1921 Will Be Ruled by Normal Needs of Industry

BY WILLIAM M. ROONEY

Fig. 1—In many instances construction work was stopped as soon as the steelwork was in place. The prospect for early resumption of work on such jobs is encouraging

SANITY in buying and selling will return to all lines of business before the first quarter of 1921 has become history and with this return to normality the construction industry, especially that phase which concerns the erection of industrial buildings and additions to present factories, will resume normal activity.

This is not a prediction, but is the consensus of opinion prevailing among leading industrial construction engineers and builders, specializing in plant construction. These engineers are of the same mind as to what hindered industrial construction in 1920, and all express the opinion that the industry will be on its feet before the summer of 1921, not at the feverish rate which existed during the past few years, but at a normal pace.

Industries Making Concessions

"Obstacles encountered in 1920 are disappearing and a comprehensive survey of the building industry in many cities, indicates a brighter outlook for 1921," says Frank D. Chase, of Frank D. Chase, Inc., Chicago. He continues: "I believe that almost every line of industrial activity, including the building industry, is voluntarily making concessions which are eliminating the profiteering of the past year, and when this action has progressed to a proper point, building activities will resume."

Another engineer who is of practically the same opinion is H. K. Ferguson, of the H. K. Ferguson Co., Cleveland. He says:

"During the past year the banks have been afraid to loan money on industrial construction projects to any great extent, because of the inflated prices, which in our judgment were due partly to the raising of prices above normal levels and labor insisting on increased wages for reduced output. These obstacles are disappearing, except that the latter is worse for the moment, but we believe that the late spring of 1921 is to see a brighter outlook."

Benjamin Towlen, of the H. M. Lane Co., Detroit, says:

"The first half of 1920 was a very busy one and judging from the number of inquiries which are constantly reaching us, we believe there will be a resumption of building activity in the spring of 1921. The cost of building materials is now on the downward trend and although much new construction is not immediately in sight, we are of the firm conviction that the country will swing back into a very busy period of construction in the spring. Therefore we believe 1921 will witness one of the greatest years of prosperity and building in the history of the country."

Two leading factors hindered industrial construction in 1920, according to H. L. Rogers, of Stone & Webster, Inc., Boston, both of which are becoming less serious. He says:

"In general there were two factors which hindered industrial construction in 1920, one of these being the high cost of building materials and the other the high cost of money. The first obstacle has become less serious, except that having started downward many prospective plant builders will postpone their construction work further in the hope of getting in nearer the bottom. The other obstacle is still serious, but we believe the indications point to a somewhat lower interest rate for 1921."

Additional Structures Will Be Needed

A. L. Chubb, of the Austin Co., Cleveland, is of the opinion that during 1921 the railroads and other essential industries will resume operations on a larger scale, which will open avenues for excellent manufacturing business in all lines and the need for additional structures. He says:

"The past year has been a very busy and successful one, and while it is expected that business will be a little quiet during the few weeks of readjustment, we anticipate a busy year for 1921. The railroads and other essential industries will require vast amounts of goods, and after the read-

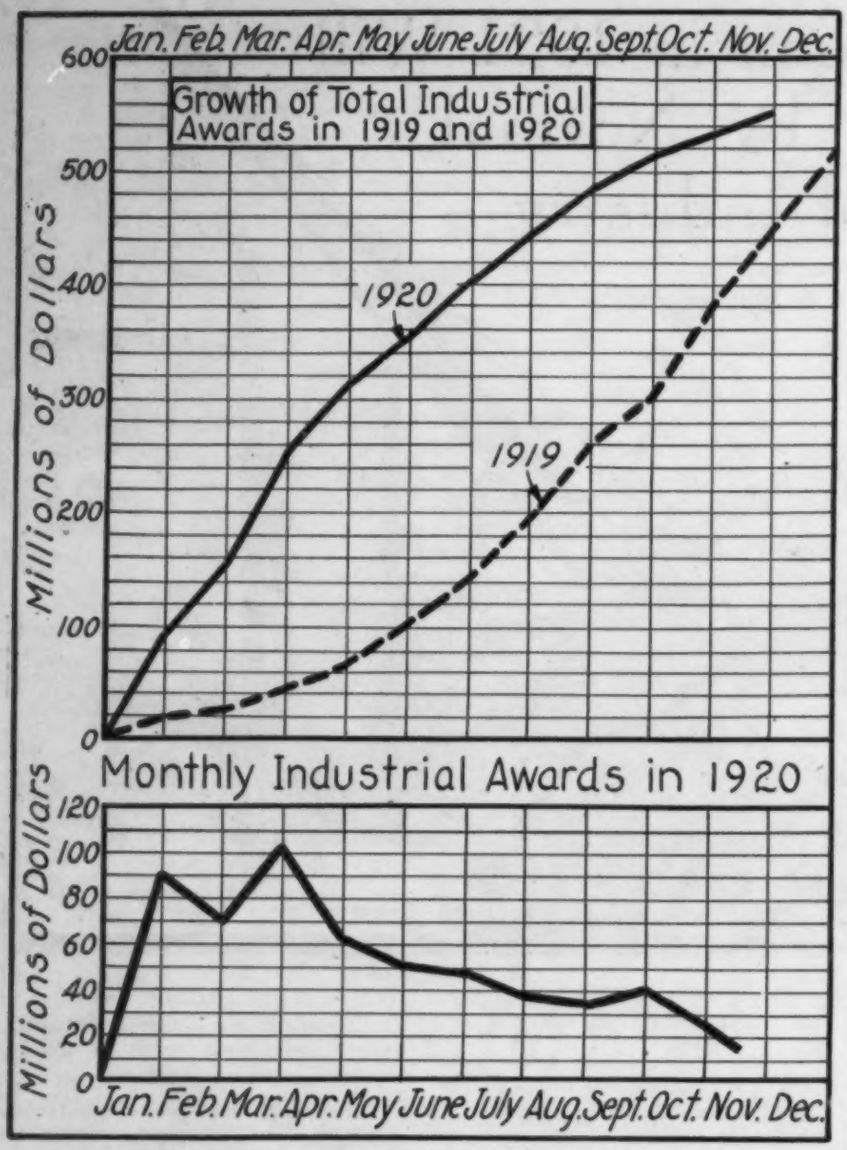


FIG. 2—COMPARISON OF AWARDS IN 1919 AND 1920 IS SHOWN IN UPPER PART OF CHART, WHILE LOWER SECTION SHOWS MONTHLY AWARDS IN 1920

justment interval, we cannot see why there should not be excellent manufacturing business and industrial construction activity."

Other industrial construction engineers, whose views were sought, are of practically the same opinion as rendered by the foregoing.

As in every other line of business, much of the industrial construction done since the end of the war, has been in lines which were purely, or to a great extent, for industries manufacturing luxuries. During these years the mania for spending recklessly has been so great that many essential industries have postponed needed plant improvements and additional buildings, because of the high cost of building materials, labor and other commodities, which was brought about by the feverish buying and which resulted in not only prices rising to unprecedented levels, but caused labor to be drawn from the essential industries. As pointed out by leading financiers and business men, this period of spending could not last forever and during the last few months of 1920 this was apparent.

Despite the many obstacles of 1920 industrial constructoin during the year was one of the greatest in the history of the country, at least as far as dollars and cents were concerned. Figures compiled by the F. W. Dodge Co., New York, show that from Jan. 1 to Dec. 1 almost $600,000,000 was spent on the erection of new plants and alterations to old ones. This is shown in Fig. 2, which was compiled from figures furnished by the Dodge Co., and cover all industrial construction activity in the 24 states east of the Missouri and north of the Ohio rivers, which approximates 90 per cent of the industrial construction of the country and represents actual awards. Although the value of contracts awarded during the 11 months of the year just past exceeds the value of all industrial awards in 1919 by more than $58,000,000, when total awards amounted to $512,924,000, this does not mean that activity in the 11 months of 1920 was greater than during the entire year of 1919. In fact, actual activity in 1919 surpassed that undertaken in 1920, the increased cost of building in 1920 as compared with the preceding year being responsible for the higher figure in the past year.

During 1919 a total of 7637 distinct industrial awards were made while in the 11 months of 1920 similar awards totaled 5853 or 1784 less. In 1919, of the total cost of construction for all kinds of buildings including residences, 20 per cent was for industrial construction, and figures show that this will approximate the percentage of industrial awards in 1920, although the amount in dollars was greater.

Approximately 153,267,000 square feet of floor space was added to the industrial plant capacity of the country in 1919, while in the 11 months of 1920, 124,657,000 square feet of space was added. This figure compares favorably with that of the preceding year.

Fig. 3, which was also compiled from figures furnished by the Dodge company, shows industrial construction in the 11 months of 920 according to industries, as compared with similar figures for 1919.

In the 11 months of 1920 awards for the erection of structures in the metalworking field totaled approximately $160,000,000, or $9,327,000 less than the total cost of awards in this field in 1919, when awards totaled $170,000,000. More money was expended in this field during the year than in any other. The erection of miscellaneous and unspecified industrial structures totaled $146,282,000 or an increase of $65,282,000 as compared with the figure for 1919, when awards amounted to $81,000,000. In the rubber working field $40,423,000 was expended on construction in 1920, an increase over similar awards in 1919 amounting to $33,000,000. Awards for the erection of buildings used in the making of food products in 1920 totaled $50,405,000, or a loss as compared with total awards of $60,000,000 in 1919. The erection of textile buildings in 1920 also showed a loss as compared with figures for the preceding year. In 1920 awards in this industry totaled $36,626,000, whereas in 1919 the figure was $48,000,000. Awards amounting to $24,570,000 were made for the erection of paper and pulp mills in 1920, as against $17,000,000 in the preceding year. Erection of central heating and power plants in 1920

amounted to $29,340,000, an increase as compared with $15,000,000 expended for this class of construction in 1919. Awards for the erection of oil mills, refineries, etc., in 1920, totaled $17,668,000, whereas in 1919 such awards approximated $22,000,000.

In considering the figures for oil mill construction, it should be borne in mind that they represent only such construction in the territory east of the Missouri and north of the Ohio rivers, and do not include construction activity in the oil fields of Texas and other southwestern states. The total figure would be considerably higher if construction in this latter territory was included.

In the 11 months of 1920 individual awards in the metalworking field totaled 1377; miscellaneous and unspecified building awards were 1799; rubber working, 123; food products, 825; textiles, cordage, etc., 383; paper and pulp mills, 188; central heating and electric power plants, 145; oil mills, refineries, etc., 103; chemicals, paints, etc., 233; mining, quarrying, etc., 187; woodworking, 237; glassworking, 44; printing and binding, 120; and leather working, 89, bringing the total of individual industrial awards to 5853, costing approximately $571,740,000.

During the first few months of 1920 the aggregate of industrial projects started was large beyond precedent, reaching its high mark in March, when industrial awards amounted to $104,000,000. From that month on awards showed a noticeable falling off. January's awards totaled in the neighborhood of $90,000,000, which was approximately 39 per cent of the total awards for all kinds of construction during the month. The awards for February fell short of the January figure, being only $70,641,000, but nevertheless, industrial construction led all other classes during that month.

High Mark in March

During March industrial awards amounted to $104,000,000, the high mark of the year. From this month on awards showed a noticeable falling off. The April figure was $62,000,000; May, $50,000,000; June, $48,000,000; July, $38,000,000; August, $34,000,000; September, $40,000,000, a slight increase; October, $26,000,000, and awards in the first half of November totaled but $14,000,000.

During the 11 months of the year individual awards for alterations and extensions to plants totaled 2747, containing a floor space of 28,916,500 square feet and costing approximately $167,596,000. These figures compare favorably with those for new plants, individual awards for which amounted to 3106, containing a floor space of 95,741,400 square feet and costing in the neighborhood of $404,144,000.

After considering these figures it is reasonable to suppose that few industrial construction projects were held up during 1920. Such was not the case. Despite the fact that much construction work was done during the year, figures compiled by the Dodge company show an enormous amount of work was indefinitely postponed. In the first 10 month of the year a total of approximately $500,000,000 was awarded for industrial construction, while projected, or contemplated work held up for a more favorable time amounted to more than $250,000,000. This figure grew considerably during the last two months of the year and this contemplated work assures the construction industry of the country a future activity of no small proportions.

Summing up industrial construction activities in 1920, it is found that the chief hindrances were the high cost of building materials, the shortage of materials, the high cost of labor, the low output of labor and the tight money market. It is evident that the year started as an era of rapid plant expansion, which toward the end developed into an era of depression, and it is reasonable to believe, according to construction authorities, that this era of depression will be followed by another of intensive plant expansion, perhaps not on as great a scale as in the past, but along more normal lines.

Prices of commodities which enter into buildings, have fallen and are continuing downward, and it is a foregone conclusion that prospective builders will go ahead with their deferred projects just as soon as they feel the market for building materials, labor, etc., is on a normal plane and at a stage where industrial buildings can be erected at a reasonable cost.

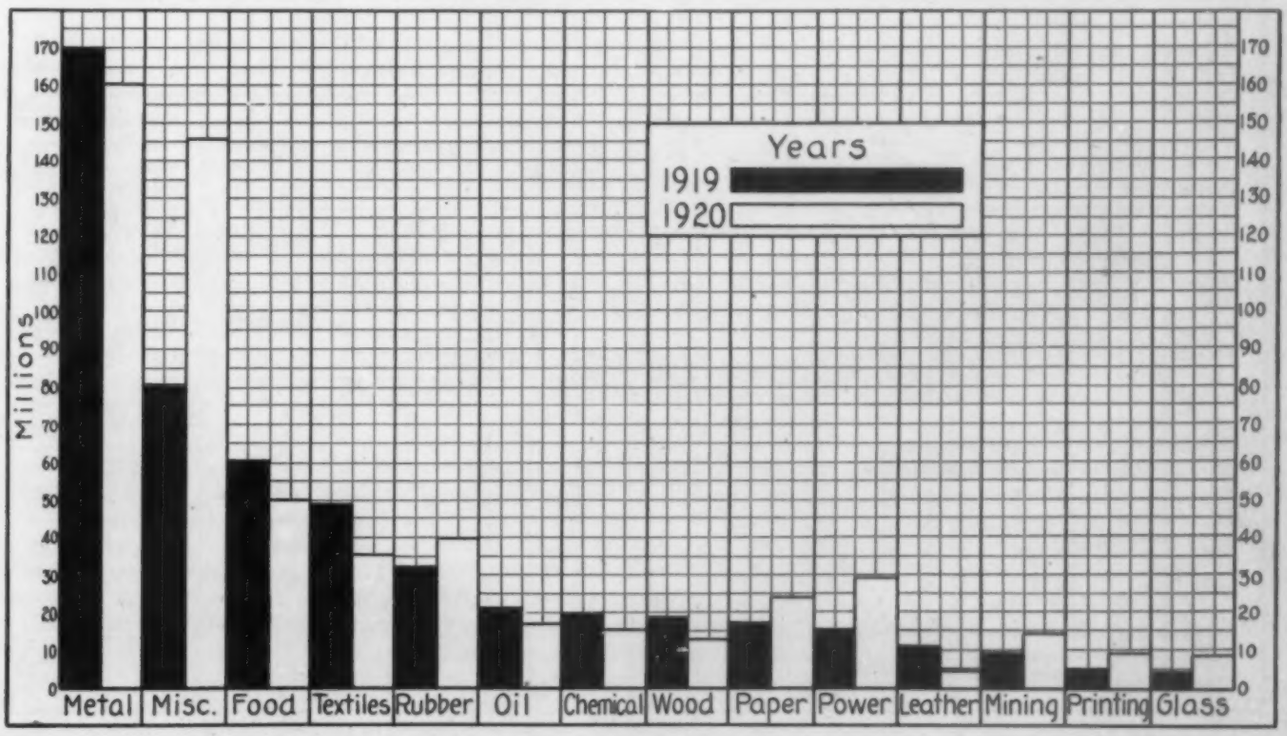


FIG. 3—COMPARISON OF INDIVIDUAL INDUSTRIAL PLANT CONSTRUCTION AWARDS IN 1919 AND 1920

Rail Tieup Blow to Refractories

Industry Recovering Slowly from Effects of Steel Strike when Handicapped Again by Lack of Transportation—Recent Price Reductions Due as Much to Slump in Market as to Lower Production Costs

NO INTERESTS were affected more seriously in 1920 by adverse transportation conditions than makers of refractories. At the outset of 1920, the industry was operating at about 75 per cent of capacity, as compared with 40 per cent during the early part of the steel strike in the fall of 1919. It was recovering slowly, despite restrictions such as embargoes, when in the spring it was again greatly handicapped. Steel producers, blast furnace operators, glass makers and other consumers were urging deliveries which could be met only in small part, and stocks were piled to the limit until October.

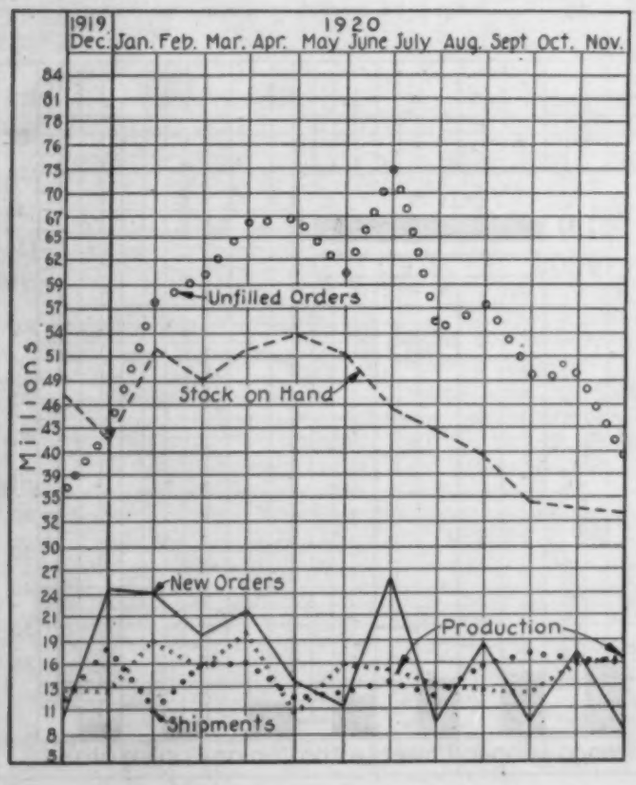
Prices reached their highest point that month, with fire clay brick at $50 to $60 for Pennsylvania and Illinois No. 1, $40 to $50 for Ohio No. 1, $45 to $55 for Kentucky No. 1, $55 to $65 for Missouri and Maryland No. 1, per 1000, f.o.b. works. Prices of silica brick were $55 to $65 for Pennsylvania, $65 to $70 for Chicago and $61 to $66 for Birmingham, per 1000, f.o.b. works. Magnesite brick was $110, chrome brick $90 to $100 and bauxite brick $40 to $50 for the 55 per cent grade, all per net ton. Prices of fire clay and silica brick were reduced $5 and of magnesite and chrome brick $10 as of Dec. 1, while bauxite was reduced $5.

The accompanying charts show the condition from December, 1919, to December, 1920, as to unfilled orders, stock on hand, new orders, production and shipments of fire clay and silica brick as they relate to makers identified with the Refractories Manufacturers' association. The data regarding fire clay brick are based on the experience of 92 makers of that product, and those relative to silica brick on 14 producers. The figures are in millions of brick, equivalent to the 9-inch, or base size.

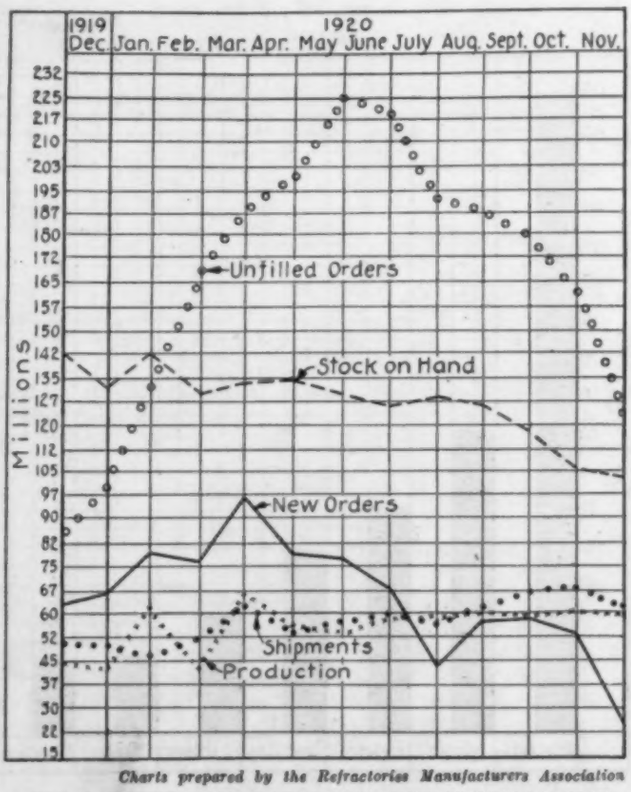
In the case of fire clay brick the lines representing unfilled orders take a sharp upward turn from the start of the period covered till June when it begins to decline as deliveries improved, the unfilled orders aggregating 225,000,000 brick at the highest peak. On Dec. 1 this total was reduced to approximately 122,000,000. The stock on hand was the greatest early in February, amounting to 142,000,000 brick, and the lowest about 99,000,000 on Dec. 1, 1920. New orders were the greatest April 1, amounting to about 96,000,000, and the lowest Dec. 1, about 23,000,000. Production was the lowest at the rate of 43,000,000 brick monthly on March 1, and the highest at 67,000,000 one month later.

Somewhat different conditions applied to silica brick. The greatest amount of unfilled orders totaled 73,000,000 on July 1, with the lowest on Dec. 1, 1919, at 36,000,000 compared with 40,000,000 on Dec. 1, 1920. The greatest amount of stocks on hand was 54,000,000 on May 1, and the lowest, 33,000,000 on Dec. 1, 1920. New orders showed frequent fluctuations, the peak having been reached July 1, with 25 000,000, and the low point Dec. 1, 1920, at 9,000,000. Production was the greatest at 20,000,000, April 1, and lowest at 10,000,000, May 1.

In October a great many makers of fire clay and silica brick put into effect a new card of extras which follows closely the percentage basis used by manufacturers of steel plates. This card was fully explained in THE IRON TRADE REVIEW of Oct. 28.



SILICA BRICK CHART BASED ON DATA FROM 14 MANUFACTURERS



Charts prepared by the Refractories Manufacturers Association

FIRE CLAY BRICK CHART BASED ON DATA FROM 92 MANUFACTURERS

"LET me tell you what perhaps some of you do not know, that within this state are billions of tons of iron ore not now considered of any value whatever, which some day will be valuable, and which may be used practically and profitably for conversion into iron and steel, and it will be hundreds of years before that ore is exhausted."—E. H. Gary, in address at Duluth, 1918.

Babbitt, the new El Dorado of the Mesabi, and specimen of sinter, actual size

Tapping the Nation's Great Reserves of Lean Iron Ores

BY A. J. HAIN

PROGRESS at Babbitt, Minn., where the magnificent mining enterprise of the East Mesabi is underway, points to the conclusion that eventually there will be established on this site the largest mill in the world for the treatment of lean ores—a plant costing approximately $60,000,000 with a capacity for handling 100,000 tons of material a day, and producing between 30,000 and 40,000 tons of iron ore concentrates.

Such are the plans in prospect, and the East Mesabi Iron Co., has gone ahead with plans to the extent of providing for the expenditure of $4,000,000; all this leading up to and providing for the construction of the first unit, from which as a separate entity it does not expect to derive any profit. Profit must come through production on a much greater scale than is possible with one unit; the whole enterprise as it has developed, therefore, is but a step toward much greater effort, or failure.

In preliminary experimental work during the past five years $780,000 was expended to demonstrate the practicability of grinding the rock of the East Mesabi into a fine powder, separating out the iron oxide by electrical means and fusing this into a "clinker" for easy shipment and handling at the furnace. The first unit of the plant which is now being constructed at Babbitt will cost approximately $3,000,000, including the necessary trackage and appurtenances. This unit is being built as part of a general plan calling for 22 units, all of the same general dimensions and capacity. It will have a capacity of 2000 to 3000 tons a day.

It is expected that the unit will be in operation by the fall of 1921 and that 50,000 to 75,000 tons of concentrates will be shipped by the end of the year. The engineers in charge of the work consider that the project has passed the experimental stage so far as it relates to the character of the material to be handled and the process for handling it. Obviously new circumstances, problems and combinations will arise, and it is those which make up the uncertainties of the enterprise now being tried out at Babbitt, although the circumstances are foreseen and charted with precise, mathematical accuracy. As a mining executive, who has studied the details of the plan for several years, stated to the writer: "It is a wonderfully big undertaking."

The town of Mesaba marks the dividing line between the rich hematite ore bodies of the western end of the range and the magnetite formation of the East. That part of the range lying east of Mesaba represents roughly about one-sixth of the total area, yet a recent geological report states that if the reserves of the East Mesabi are to be considered as "available at present" then "they will more than double the reserves of the range."

From Mesaba, which town is dwindling away, as a result of the depletion of the hematite mines in its vicinity, a single railroad track extends out over a hilly country, 15 miles away to the new El Dorado. Here at the northeastern tip of the range are 25 frame buildings, the temporary living and working quarters of 400 men. Several hundred yards away, in a straight line down a slope and facing the North are the foundations for the first unit. The steel framework for the plant is being erected and other material is on the site as well as some equipment for the crushing plant. A

machine shop has been improvised and a power plant is being erected to replace the small temporary structure.

This, in brief, is Babbitt as it appears today, but the story of interest is not the precise stage at which construction is under way when it is moving along under competent hands, but in the broader view, the thoughts of the engineers as to their resources and reserves, their plans, means and mechanisms, and finally how it all fits with the established industry of mining and merchandising ore.

The logic in acquiring the deposits of the East Mesaba and beginning costly development work at a period when production of high grade ore is so easy, and output sufficient for the needs of the day is this: The Lake Superior district has the resources and must be for many, many generations the chief source of supply for that part of the American iron industry situated between the mountain ranges in the East and the Rocky mountains in the West. Chilean, Spanish and Swedish, and possibly Brazilian, ores may be brought to the United States and used by furnaces along the Atlantic, but under present conditions the ores cannot be transported commercially over the mountains and brought to the heart of the country. Mines may be opened up in the territories West of the Rockies, but similarly for reasons of transportation they cannot be marketed in the great central territory.

The proposed new water route from the Great Lakes to the Atlantic might seem to open the way for bringing to the lakes iron ore from the great beds in Newfoundland, but mining interests consider competition from this source as remote. Reserves have been discovered recently in the Hudson Bay district, with the possibility of development, but here again, weather and transportation difficulties weigh against it. These are possibilities, no doubt, to be considered "when the Lake Superior district approaches exhaustion," but the fact is that considered as a whole there is no sign yet of the exhaustion of the mineral wealth of the Lake Superior district. Big mines are becoming depleted rapidly, but reserves of high grade iron ore "in sight" actually are increasing on some of the ranges, while the tonnage of the lesser grades are measureless. With the principal market and mines thus in fixed relationship with one another, it becomes only a matter of experience and judgment on the part of the Lake Superior operators in selecting those properties which at the time promise to be the most profitable.

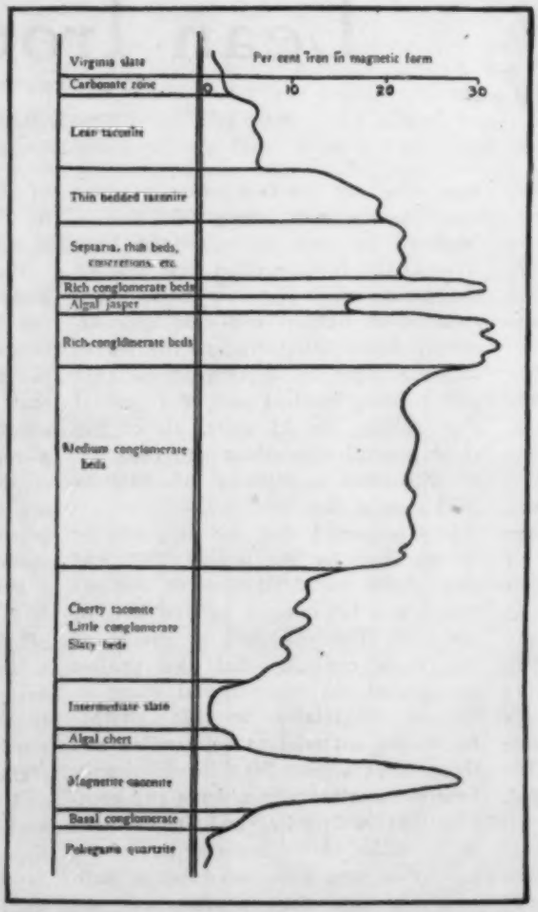
Estimating Reserves

A considerable difference of opinion exists as to what are to be considered iron ore reserves, and before a clear understanding can be reached the meaning of "iron ore" must be defined. The practical mining man of the Lake Superior district will speak of reserves as merchantable ore, conforming as mined with the prevailing market standards, or capable of being mixed to conform with market standards, 55 per cent metallic iron in the bessemer and 55½ in nonbessemer. The operator in the Port Henry field from which the ore is shipped as concentrates will have a lower standard in mind in speaking of reserves and the same is true in Alabama.

Bases of comparison are not uniform either in the United States or abroad; ore for which there would be a ready market in one district or country would not be suitable under the conditions prevailing in another. In some instances "iron bearing formation" as understood and estimated by geologists is confused with merchantable supplies as interpreted by the mine operator. This same confusion exists among the mining men of the Lake Superior district. The operators or owners understand that there are at least 2,450,000,000 tons of standard iron ore in the ground and call these reserves. At the present rate of consumption these reserves are sufficient to supply the market for 40 years. On the other hand, in estimating reserves some geologists include all low grade ores and iron bearing formation and place the figure as high as 30,000,000,000 and more, "enough to supply the world for 1000 years." The iron bearing formation in the Lake Superior district is so vast that the foremost geologists will not attempt to estimate the tonnage contained in it.

Operators know that for each drop of 10 per cent in the proportion of metallic iron, billions of tons will be added to reserves as calculated by operators in future years; but for them it is idle to speculate as to the tonnage or in what year all of it will have vanished. The means at hand for utilizing the low grade ores will in a large measure determine what are to be considered as reserves at successive stages in future developments. In the operators mind "reserves" are linked inseparably with taxes, and taxes are charged only against iron ore marketable at the specific period.

Reserves of marketable ore in Minnesota amount to about 1,700 000 tons, which includes the wash ores, but not magnetites. Reserves in Michigan and Wisconsin probably amount to 750,000,000 tons. This is a much higher figure than generally assumed, but is based on sound geological reasoning. The deepest levels to which the leading mining companies have worked recently have disclosed great tonnages, and the maintenance of known reserves at a constant level in Michigan despite shipments is one of the most important feature of interest in the whole district. Michigan's known reserves have been increasing during the past few years in greater proportion than Minnesota's, indicating the value of the underground properties and that they are to become more depended on for supplies in the



CURVE SHOWING THE VARIATION IN MAGNETIC IRON CONTENT IN THE SEVERAL HORIZONS OF THE IRON FORMATION OF THE EAST MESABI. THE DEPTH IS APPROXIMATELY 400 FEET

PROGRESS pictures at Babbitt, Minn., showing construction work at various stages during past year. Upper, mouth of incline under big crusher pit; next lower, steel framework for power house, located alongside mill site; next, grading switchback on railroad down the hill through mill site; lower, locomotive cranes grading mill site. All of the underground work for the mill, constituting a large proportion of the construction work for the mill proper, has been done. Insert shows Babbitt in relation to other points on the Mesabi range. Birch lake, shown on the map, may be seen in one of the photographs. The East Mesabi Iron Co. is planning to have the mill in operation in time to make a substantial shipment of ore in the fall of 1921. The nearest shipping point on Lake Superior is Two Harbors.

future. A recent report on the investigation of the magnetite deposits of the East Mesabi issued by the geological survey, University of Minnesota, states: "A rough calculation indicates that the East Mesabi range from Birch lake (Babbitt) to Mesabi contains about 1,500,000,000 tons of this magnetic formation within 100 feet of the surface without any bed rock cover. If such a reserve is to be considered as available at present it will more than double the present reserves of the range."

Reserves of low grade magnetites, averaging from 25 to 30 per cent iron, evidently are compared with about 1,300,000,000 tons of high-grade merchantable iron ore of the western end of the Mesabi, as estimated by the Minnesota tax commission. It is pointed out that "if the lean bodies of wash ores of the West Mesabi are to be included, these magnetic ores may well be added also." According to this, the reserves "available at present" of the Lake Superior district would be 4,000,000,000 tons, instead of 2,450,000,000 the added tonnage be-

ing that contained in the East Mesabi.

The magnetic ore body of the East Mesabi extends down to an average depth of 400 feet with an average iron content of from 20 to 25 per cent, and therefore the reserves of iron formation in this body may be roughly calculated as 12,000,000,000 tons. The point of difference, however, is that in the latter instance 20 or 25 per cent ore is set up against an average 55 per cent ore, and the comparison fails. If all the ore of a similar low grade contained in the West Mesabi were taken into consideration the East Mesabi would by no means double that figure. The comparisons are only interesting as showing what resources in crude material the East Mesabi Iron Co., has with which to work, the company owning practically all of the deposit.

If its effort to commercialize the magnetites are successful it will then be but a step to commercializing the lower grade hematites by similar means. It is well known that hematite may be converted to magnetite through the process known as magnetic roasting, which consists simply of heating the ore with a small percentage of fuel when oxygen is driven off and hematite is changed to magnetic oxide. This process is not in use on a commercial scale, but it might readily become so if magnetic separation is proven to be of financial worth. At present the lean hematites, containing from 35 to 40 per cent iron are useful only for mixing with the higher grade ores, and when the latter are depleted concentration will be imperative. That is why so many companies owning or operating properties on the West Mesabi are deeply interested in the East Mesabi venture.

Difficulties to be Overcome

While the magnetites of the East Mesabi were the first to attract the attention of explorers on the range, in the 60's, the subsequent discovery of the richer ores further west led to abandonment of interest in the East. Geologists, however, became well aware of the character of the magnetite formation, and at various times mining companies sank drills, concluded that mining would be impracticable, and withdrew.

The Lake Superior district proved to be such a wonderful storehouse that these mining companies could see no advantage in experimenting. However, while their attention was focused almost completely on their own properties, a mining explorer in Duluth, George St. Clair, now 73 years old, working in the field over a period of 25 years, gradually acquired control of the greater part of the eastern range. He persistently sought to interest some of the old established companies. As time went on the East Mesabi was punctured with drill holes; mining companies understood thoroughly what was in it, but were not willing to incur the risk involved.

The ore could not be handled as are the richer qualities of magnetites found in the Port Henry district, which do not have to be ground to a fine powder as a preliminary to obtaining a high-grade concentrate. Certain additions and refinements were necessary. This would be an open-pit project; open pit mining is limited to about six months of the year; the overhead charge on an idle plant of the capacity required would be enormous, even if magnetic separation itself were satisfactory. All the advantages and obstacles were considered, but not so minutely or in the light of the experience it remained for other men to bring to the task.

D. C. Jackling, the engineering genius of the Utah Copper Co., an expert in the handling of low-grade ore, became convinced that the application to this low-grade material of the methods which made the so-called porphyry copper properties successful, would solve the problem. Experimental work was begun in 1915. Mining engineers went out to Argo, an abandoned lumber camp situated near Babbitt, from where they conducted their

TYPICAL OUTCROPPING OF TACONITE ON THE EAST MESABI. GREAT AREAS HAVE NO OVERBURDEN. THE CRUDE ORE IS TO BE SCOOPED UP AND SENT DIRECTLY TO THE MILL. THE OVERBURDEN AVERAGES BETWEEN 2 AND 3 FEET, NOWHERE BEING DEEPER THAN 9

work on the range. Material was shipped to Duluth, put through a small mill and eventually 2000 tons of concentrates were shipped to the Midvale Steel Co., which company later became financially interested in the project. Subsequently other shipments were made. Research progressed continuously and by the time the results were generally known, the interests here mentioned, together with Hayden, Stone & Co., had obtained control of 23 square miles, including not only the magnetite formation, but some of the outer fringe as well.

Coming down to the point as to how this raw material of the East Mesabi is to be mined, concentrated and marketed in competition with the other ores: In the development of an open pit mine stripping entails a heavy expenditure; on the East Mesabi comparatively little stripping is to be done and in large areas absolutely none. The deepest overburden is 9 feet, the average of all, two to three feet. Eliminating much of the usual cost for removing overburden and the fact that it owns the fee of the deposits which are to be first mined, the company starts with an advantage of about $1 a ton over the costs of mining in other open pits. However, this advantage is largely diminished by the fact that it must mine at least 2½ tons of crude material to produce one ton of shipping product. It is proposed to ship concentrates containing approximately 65 per cent metallic iron, with a phosphorus content of between .02 and .025, which at the current rate would command a price of about $9.31, delivered at lower lake ports, in comparison with $7.80 for a ton of old range bessemer ore guaranteed to contain 55 per cent iron natural and allowance for the premium for low percentage of phosphorus. Freight unloading and insurance, figures up to $2.39, leaving $6.92. Similar charges amounting to $2.20 applying to old range bessemer ore reduce the corresponding figure to $5.50. The difference, $1.33, roughly may be allowed for the extra operation entailed in producing a ton of the East Mesabi ore. The comparison is made with the old range bessemer ore owing to the fact that it is commanding a higher price than the Mesabi base grade and it is nearest the market. The average cost of mining and shipping a ton of standard bessemer ore from open pit mines in 1919 was $4.26 with an average profit of 70 cents. Estimated cost figures on the East Mesabi project indicate that the company not only will be well within the margin necessary for competition, but profit will compare very favorably with, if not greatly exceed, that on the standard base grade.

One of the most important points to be considered in this cost question is this: The function of a blast furnace is not only to produce iron from ore but to eliminate waste material. This is made into slag in the furnace, an expensive method. The enterprise being undertaken at Babbitt aims at the elimination by cheaper methods, and at the mines, so that freight and handling charges are reduced to a minimum.

As stated, the chief difficulty anticapated by some of those interests which are watching the experiment is the continuous operation of the plant. The company, however, plans to overcome this by stockpiling during the summer months so as to equalize the supply and allow of operating throughout the winter. Another point raised by some mining men relates to the means of disposing of the waste from the mill. A large percentage of this will be discarded as hard waste rock of small, uniform size and will be shipped as a by-product for road building and railroad ballast.

The mining will be carried on with steam shovel after the usual manner, with some quarrying to be done in side hills with faces 40 to 60 feet high. The crude material will be conveyed to the mill on a standard gage railroad.

Description of Plant

The first unit of the plant will be approximately 2500 feet long and 66 feet wide with framework of steel erected by the Minnesota Steel & Machinery Co. and asphalt siding and roofing. In reality it will comprise six separate sections, suitably spaced to allow of the equalizing of supplies. The first section will contain a jaw crusher 48 x 72-inches, of special heavy construction, 340,000 pounds in weight, with a foundation area of 10 x 15 feet. It will have a capacity of 15,000 to 20,000 tons a day. It will crush the crude material, consisting largely of rock to 12-inch size. From this crusher the material will pass by gravity to the second, a 36 x 54-inch jaw crusher, weighing 224,000 pounds. In this it will be ground to 5-inch size and continue to pass by gravity to four gyratory crushers which will grind it to 2-inch size.

The next step in the process is to pass the material by belt conveyor to dry magnetic separators working with 72 x 20-inch rolls, reducing it to ¼-inch size and discarding about 50 per cent of it as waste. This machine is known as the drum roober and consists of a short belt conveyor 30 inches wide and 6 or 8 feet in length. The head pulley traveling at a speed of 200 feet per minute is equipped on the inside with stationary magnets. As the crude material comes from the rolls it is distributed evenly over the surface of the conveyer belt near the tail pulley. Reaching the magnetic head pulley, the nonmagnetic waste particles fall into one compartment while the magnetic particles cling to the belt and are carried around to the underside of the drum and there fall into a separate compartment. This type of machine is now in use in the handling of iron ore in the Port Henry district and elsewhere. In East Mesabi practice a shipping concentrate also could be taken out at this point, although not so desirable as it is purposed to make the finished product.

The next section consists of ball mills grinding the 1/8-inch material in wet condition to 100 mesh and passing it on to the wet magnetic separator. This is of the Davis type, as designed, built and tested in the laboratory of the Minnesota school of mines experiment station. It is similar to an ordinary log washer in construction with the exception that to the bottom of the tank is attached a series of magnets. These magnets hold the material to the botom of the trough where the action of the logs forces the settled ore up a slope and delivers it as a clean concentrate, while the nonmagnetic material is kept in agitation and is washed over the rear end of the machine as tailing. The machine is simple and economical in operation, while the wear on the logs is much less than in ordinary log washers, due to the fineness of the particles of ore which are treated.

The remaining unit of the mill consists of the sintering machine, fusing the product into a clinker having the structural appearance and size of coke. Some of the iron in this sinter will be hematite and some magnetite, the percentages being varied according to the treatment on the machine.

In the sintering process, the fuel used is around 4 to 5 per cent, of the weight of sinter produced. Coke breeze, anthracite dust, bituminous dust, or fines from any source can be used, such as dock sweepings. The time for sintering runs about 20 minutes, depending somewhat on the depth of the charge used on the pallets. The sintering machine has a rated capacity of about 500 tons per day.

Where the sintering process to be used differs from the methods in or-

(*Concluded on page* 44)

Stability and utility as well as picturesqueness characterize these concrete shaft houses built at the Cliff Shaft mine, Ishpeming, Mich., by the Cleveland-Cliffs Iron Co. They are the first of their kind on the ranges

Heavy Ore Demand In Prospect

Operators Anticipate Good Season After Industrial and Trade Readjustments Are Made—Price Question Receiving Attention as Furnaces Insist on Reduction—Review of 1920 Shipping, Operations and Developments

REVIEWING the year 1920 in the iron ore trade the fact which stands out most conspicuously is that despite the many difficulties which arose the operators succeeded in shipping approximately 60,227,226 tons. At the beginning of the season there was the strike of ore handlers at the shipping docks; then followed the dislocation of the transportation system due to the strike of railroad switchmen; shortage of coal, shortage of cars, and shortage of vessels as a consequence of the scarcity of fuel. At some of the mines, operations slowed down for several months, while later in the season when the mines were operating normally and transportation had improved, many furnaces were blown out and demand was not so heavy.

In the face of these obstacles, the tonnage shipped was 11,680,575 in excess of 1919; within 2,608,946 of 1918 and but 6,431,240 less than in the banner year of the ore industry, 1916. This is a reflection of the improved methods employed in the mining of ore. The mines were never in a better position for producing great tonnages as they are today, and granted the demand, they could exceed the 66,658,466 tons of the year 1916 without any strain whatever.

The position of the trade is shown in a measure by a few comparisons. The tonnage of ore on lower lake docks and at blast furnaces as of Jan. 1, 1921 is estimated to be 38,000,000, of which 10,500,000 to 11,000,000 tons are on the docks. On Jan. 1, 1920, the tonnage on docks and at furnaces was 36,874,000 and Jan. 1, 1919, 37,687,000. So far as readily available supplies are concerned, the furnaces begin the new year on practically the same basis as regards to ore as they did a year or two years ago. That they anticipated using a much heavier tonnage in 1920 than they actually did is shown by the large tonnage they are carrying ove bought at prices which they considered high.

In answer to the question: What of the outlook in the ore trade for 1921, many operators are confident that "it is exceedingly bright." They note the drop in prices of pig iron and semifinished and finished material and conclude that "a great buying movement" is about to begin, which inevitably must be reflected in the demand for ore. Others are not so enthusiastic; they raise the question as to how long buyers are going to hold off; how long it will take to "liquidate", but generally believe that the iron and steel market will open up some time in the spring and that this will lead to a fairly good year in the ore trade, with heavy shipments late in the season. None is pessimistic, while most agree that the outlook at present is far better than it was in the early spring of 1920, when the furnaces came into the ore market to the extent of buying 62,000,000 tons.

Prices of iron ore for 1921 already are receiving attention. Operators are compiling cost figures. The feeling prevailing among them is that the spread between ore and iron prices has been too broad and that they cannot reduce ore in the same ratio as pig iron has been reduced. One large ore producer recently stated that "there is no chance" for cutting the price of ore "unless pig iron goes below $30", while almost in the same week a Detroit furnace of a motor car builder offered iron at $31, and iron prices generally have been moving slowly but surely to lower levels.

Meanwhile wages are coming down, and this opens the avenue for possi-

ble reductions in ore prices. The Charcoal Iron Co., of America reduced wages at the Yale mine, Bessemer, Mich., 20 per cent, while another important operator has announced a 25 per cent reduction. The ultimate decision as to wages, however, would seem to depend largely on the attitude of the leading interest and its policy is not to cut wages unless it is absolutely necessary, but to rely on improved mechanical devices and more efficient methods to reduce costs.

Another possible means for reducing the price of ore to the consumer is a reduction in lake vessel rates and in railroad rates from the mines to the upper lake docks. In the latter instance, the operators have taken steps to procure lower rates by filing suit with the interstate commerce commission.

All costs of putting iron ore into the market have advanced by leaps and bounds, and if there is to be a general readjustment on a lower plane, the fact that there is distinctly easier tendency in the labor market in the Lake Superior district would seem to presage a reduction in wages. It is believed this would lead to lower prices of ore. Many hundreds of the men who deserted the mine for the industrial plants of Chicago, Detroit and other cities are drifting back to the North. The reaction set in several months ago; operators thought efficiency would be increased as a consequence, but very little was noticed. It is to be expected that some other companies will follow the example of the Charcoal Iron Co., but, as stated, the policy of the Oliver Iron Mining Co., largely enters into the equation, and back of this is the policy of the United States Steel Corp., which, as well known, is to be as liberal as possible at this time with labor. In any event, the decision must be known in the next two or three months, for it may affect ore prices and prices must be quoted by spring. Furnace interests are demanding a cut, and some operators concede that it is not altogether improbable a slight one will be made.

Approximate Shipments by Ranges

	1920	1919
* Mesabi	36,493,418	31,997,699
* Vermilion	949,610	929,049
* Cuyuna	2,127,168	1,861,165
Total Minnesota	39,570,196	34,787,913
* Gogebic	8,180,852	6,230,839
* Marquette	4,225,690	2,992,212
* Menominee	6,550,488	4,442,868
Mayville, etc.	100,000	92,819
Misc. shipm'ts by rail	1,600,000	†
Grand Total	60,227,226	48,546,651

* Includes lake shipments only in 1920
† Absorbed in range figures for 1919

Generally speaking there was comparatively little new development work on the ranges during the past year. An important phase of the situation is the increase in available tonnages in Michigan, as brought to light recently, and another is the growing demand for the maganiferous ores of the Cuyuna, brought about through blast furnaces practice. However, the subject of reserves is treated in the preceding article dealing with the important operations of the Mesabi Iron Co., at Babbitt, Minn.

A comparative statement of reserves in Minnesota just issued by the tax commission of that state gives the total of merchantable iron ore in the ground estimated in the spring of 1920 as 1,330,510,471. This represents a decrease of 64,412,980 from the tonnage as estimated for taxation purposes in 1919.

It merely reflects a more liberal attitude in taxing ore properties. For instance, 34,473,070 tons were eliminated from the taxable reserves of the Cuyuna range, and 29,234,507 on the Mesabi range. The magnetite ore body of

CLEVELAND-CLIFFS IRON CO., DIRECTORS AND OFFICIALS, AT ISHPEMING, MICH.

Left to right, front row: The late M. B. Johnson; J. H. Wade; W. G. Mather, president; C. W. Bingham; Samuel Mather; M. M. Duncan, vice president and general manager. Second row: J. R. Reigart, assistant superintendent Gwinn district; J. E. Jopling, chief engineer; A. J. Youngbluth, purchasing agent; J. M. Bush, superintendent North Lake district; O. D. McClure, chief mechanical engineer; C. V. R. Townsend, land agent. Third row: Lucien Eaton, superintendent Ishpeming district; C. J. Stakel, superintendent Republic and Spies mines; O. W. Graff, superintendent Gwinn district; W. H. Moulton, sociological department; G. R. Jackson, superintendent Negaunee district; C. J. Shaddick, assistant auditor

THE MONARCH OF THE RANGES. HULL-RUST PIT, OLIVER IRON MINING CO., AS IT APPEARS TODAY

the East Mesabi is not assessed as iron ore property, while it follows that if the lean ores of the East Mesabi are to be dealt with leniently then the low-grades of the western end of the range, also, should receive similar consideration. However, the assessed valuation of the Mesabi iron ore has been raised from a total of $271,035,121 to $274,153,621, while the valuation of the Cuyuna ores has been reduced from $4,073,558 to $3,010,603. The stockpiled ore in Minnesota, it is to be noted, amounted to 10,881,082 tons on May 1, 1920, as compared with 4,912,403 tons a year previous. Complete details of tonnages and assessments are given in an accompanying box.

As to shipments, the Oliver Iron Mining Co., sent forward in 1920 approximately 3,000,000 tons more than in the previous year, which gives 25,065,148 for 1920, or roughly 41 per cent of the total. In 1919 the exact percentage was 45.20 and in 1918 41.66.

The balance of ore on dock at Lake Erie ports Dec. 1 was 10,955,868 as compared with 10,454,843 at the same time in 1919. Shipments from the docks to Dec. 1, 1920 amounted to 32,016,654 tons as compared with 25,306,777. The receipts at Lake front furnaces to Dec. 1, 1920 were 9,132,175 tons, as against 7,481,182.

In the development of mechanical devices the new feature of greatest interest is the use of labor-saving electrically operated shovels. Operators say these have not been in use long enough to determine the relative cost in operation in comparison with steam-operated shovels, or whether or not experience will show that a material saving will be affected. It appears, however, only a question of time until the use of electricity will be more general in mine operations such as underground pumping, hoisting, air compressing and stripping and open pit mining. There has been some talk, which has not as yet led to definite action, of building somewhere on the Mesabi range a large power plant for supplying current for all mining operations. An adequate and absolutely reliable source of current is necessary before the operators can go into the matter of electrification to a greater extent. Several motor-driven underground pumps installed recently are reported to be giving excellent service, thus insuring more extensive use.

M. A. Hanna & Co., took the initiative in 1920 in the use of electric shovels. A 300-ton Marion is stripping the Wabigon mine, at Buhl, Minn., which will be one of the largest open pits on the Mesabi range. It is estimated that 2,000,000 cubic yards of overburden, of an average depth of 50 feet, is to be removed before ore is shipped from this mine in 1923. The only other electric shovel in use is a 300-ton Bucyrus, the Hanna company using it in stripping the La Rue mine. A central electric power station has been built at the Frantz mine and serves all electrical equipment at the Frantz, Wabigon and Thorne properties.

Progress is being made continuously in the electrification of mining equipment on the principal ranges, the most notable extensions having been made during the past year by the Oliver Iron Mining Co., on the Gogebic. A 22,000-volt transmission line has been extended from the central power plant at the Pabst mine, Ironwood, to the Puritan, Davis and Geneva mines at Bessemer, Mich. The McKinney Steel Co., has installed the largest motor in use in the Lake Superior ore district at the Ironton mine, Bessemer. This is a 1650 - horsepower direct-current motor manufactured by the General Electric Co., and will drive the first-motion ore hoist, the second being driven by a 400-horsepower induction motor. The McKinney company also has electrified its equipment at the Richards and To-

Reserves by Ranges

Ranges	1920	1919
Mesabi	1,295,801,067	1,325,035,574
Vermilion	10,353,834	11,059,237
Cuyuna	24,355,570	58,828,640
Total tonnage	1,330,510,471	1,394,923,451

Minnesota Ore Reserves and Assessed Values

County	May 1, 1919, Ore in the Ground Tons	Assessed Value	May 1, 1920, Ore in the Ground Tons	Assessed value
St. Louis	1,180,822,166	$257,791,519	1,155,367,352	$261,532,530
Itasca	155,195,645	18,734,720	150,707,549	19,017,515
Lake	77,000	19,950	80,000	5,000
Crow Wing	58,828,640	4,073,558	24,355,570	3,010,603
Totals	1,394,923,451	$280,619,747	1,330,510,471	$283,565,648

County	In Stock Pile Tons	Assessed value	In Stock Pile Tons	Assessed value
St. Louis	3,978,380	$5,824,694	9,744,533	$11,397,445
Itasca	340,110	430,633	589,990	966,022
Lake	29,110	51,093	2,170	2,270
Crow Wing	564,803	520,899	544,389	653,735
Totals	4,912,403	$6,827,419	10,881,082	$13,019,472

County	Total Merchantable Ore Total in Iron Ore Tons	Assessed value	Total Merchantable Ore Total in Iron Ore Tons	Assessed value
St. Louis	1,184,800,546	$264,488,025	1,165,111,885	$274,213,373
Itasca	155,535,755	19,372,952	151,297,539	20,223,052
Lake	106,110	90,843	82,170	46,680
Crow Wing	59,393,443	4,985,410	24,899,959	4,079,459
Grand totals	1,399,835,854	$288,937,230	1,341,391,553	$298,562,564

The assessments given above do not include assessments for surface values, structures or improvements.

FROM THIS MINE, OPENED IN 1896, APPROXIMATELY 57,000,000 TONS OF ORE HAVE BEEN REMOVED TO DATE

bin mines, Crystal Falls, Menominee range.

The tendency continues toward heavier, larger and stronger equipment, and this is in conspicuous evidence on the Mesabi. Equipment has been revolutionized in the past 10 years. A new spreader recently appeared on the range. Formerly a regiment of men were employed to level out the overburden removed while stripping; later this was accomplished more or less imperfectly by a mechanical spreader. The new machine is nothing more or less than an engine equipped with heavy cast steel wings, and as massive as a man-of-war. When the dump cars have deposited the dirt alongside the tracks the machine gets up speed and rams into it. If the banks are unusually large, a second or third ramming may be necessary. The earth is leveled down to a distance of 20 feet on either side of the track, thus preparing a perfect roadbed for the track to be shifted upon. The particular new features of this spreader are its weight, strength and ease with which the different operations may be performed. Its cast steel wings are capable of very quick adjustment by means of compressed air.

Scarcity of labor on the Mesabi range has forced the operators to use track shifters for moving tracks sidewise on the dumps. This machine was developed on the Panama canal, but Mesabi range practice demanded that it be made heavier and stronger, built on steel frame cars and somewhat improved in detail. The old way of shifting tracks by means of a gang of laborers has disappeared. The new machine picks up a section of the track, ties and all, and swings it over into its new position, moves on and repeats the operation until the entire length of track is relaid.

In the open pits tracks frequently must be removed and relaid. The labor of pulling spikes, picking up ties and rails heretofore was done by manual labor. Locomotive cranes now are extensively used for this purpose and a section of track of one rail length with ties attached is picked up bodily and placed in its new position. In addition, it is customary to build sections, laying the ties on the ground and spiking the rails thereto, preliminary to loading the sections on flat cars and taking them to the pits where they are unloaded by a crane and placed in position. As yet the loading and unloading of these track sections has not been accomplished by the use of an electric magnet but it is anticipated that this will be accomplished some day, thus further reducing the number of men required to handle the chains and shackles to lift the sections.

The use of locomotive cranes is being extended rapidly and the cranes are being increased in weight and capacity. In tamping tracks in connection with the tampers, the use of which also is being greatly extended, many locomotive cranes now are equipped with grab buckets. These grab buckets pick up a yard or more of dirt and gravel, depositing it between the rails while the tie tampers proceed to do the rest of the work. This procedure eliminates a large amount of labor originally expended in shoveling the dirt in place.

The Oliver Iron Mining Co. recently placed an order for 130 steel air-dump cars of 30 cubic yards capacity to be used for stripping. The operation of these cars will be watched with interest as cars of this size introduce a good many interesting questions such as the weight of rails, the moving of tracks, making of grades, etc. Standard sized stripping cars now in use are of 20 cubic yards capacity. The new cars are to be equipped with two 20-inch dump cylinders on each side, and are calculated to carry a load of 150,000 pounds or 75 tons. The weight of the car is approximately 75,000 pounds, making a total wheel load of 225,000 pounds.

Coincident with these developments 75-ton ore cars, 50 per cent larger than standard ore cars heretofore in use, have made their appearance on the Mesabi range and this has led to a corresponding increase in the weight of locomotives. This development will be described and illustrated in a subsubsequent issue of THE IRON TRADE REVIEW. While the efforts being made to utilize the low grade magnetites of the eastern end of the Mesabi range is the most notable development in this direction in a decade, concentrating plants continue to be built elsewhere in the Lake Superior district. It was in 1910 that the Oliver Iron Mining Co. built the first

Ore Shipments by Ports and Months

Month	Escanaba	Marquette	Ashland	Superior	Duluth	Two Harbors
April	.....	.....	.....	205,586	25,268	.....
May	795,673	375,036	1,013,049	1,983,660	1,662,971	1,145,696
June	1,147,136	553,367	1,299,820	2,256,250	2,528,446	1,448,547
July	1,174,468	610,321	1,293,239	2,249,431	2,783,537	1,527,610
August	1,277,561	602,567	1,327,294	2,266,497	2,351,918	1,444,926
September	1,088,806	493,311	1,253,633	2,330,512	2,304,726	1,452,494
October	1,030,683	482,495	1,260,162	2,274,801	2,432,465	1,368,380
November	791,130	298,011	726,985	1,245,661	1,390,003	853,948
December	55,613	.....	6,670	.....	.....	36,863

Month.	Escanaba	Marquette	Ashland	Superior	Duluth	Two Harbors
April	71,417	147,358	.....	101,730	794,050	297,684
May	583,463	151,749	669,647	1,250,536	2,957,338	1,002,608
June	759,647	296,127	951,287	1,889,294	2,947,651	1,136,833
July	1,007,035	443,850	1,176,553	2,244,907	3,122,098	1,178,985
August	336,334	277,943	375,245	872,335	1,645,788	847,944
September	939,099	431,995	1,190,086	2,033,804	2,591,750	991,749
October	756,926	820,222	878,031	1,830,472	1,886,951	569,281
November	483,046	251,149	527,176	615,903	875,584	399,461
December	26,390	.....	.....	.....	20,272	.....

commercial washing plant on the Mesabi, range, at Coleraine. Today there are 21 such plants in Minnesota, 19 of which are on the Mesabi and the others on the Cuyuna. Four plants were built during the past year, three of which were on the Mesabi.

The Cleveland-Cliffs Iron Co., built a plant at Calumet, Minn., in record time for treating the ore from the Hill-Trumbull mine. The erection of steel began in May and the plant was in operation by Aug. 22, approximately 143,000 tons of concentrates having been shipped in 1920. It has a capacity for treating 4500 tons of iron ore in 24 hours.

The plant is practically a duplicate of the company's plant at the Crosby mine, Nashwauk, but some improvement was made in the construction of the receiving bin, of heavy concrete to withstand the shock of ore cars. The company uses 20-cubic yard side dump cars in place of the usual hoppers.

The Jones & Laughlin Steel Co., built a plant of similar capacity at Calumet to treat ore from the Hill-Annex mine, but installed the gravity system of conveying, while at the Cleveland-Cliffs plant the ore is taken up by a 36-inch belt conveyor.

A plant with a capacity of 1000 tons per 24 hours was built by W. W. Bowe and R. L. Burke who have leased the Mariska mine at Gilbert, while a plant also was built at the Moroco mine, at Trommald, on the Cuyuna range, by the Marquette Ore Co. In addition to these, a new crushing plant was built at the Warren open pit, Hibbing, a Tod-Stambaugh property. The plant's capacity is 1400 tons in 10 hours.

The Cleveland-Cliffs Iron Co., expects to ship ore from shaft at the Boeing mine, formerly the Bourne, on the Mesabi range, some time in 1921 and from the open pit in the year following. It is estimated that 6,000,000 cubic yards of overburden, which averages 130 feet in thickness will have been removed. The Boeing includes two forties and promises to be one of the largest shippers on the Mesabi.

This company during the past year acquired from the Wickwire Mining Co., the lease to the Virgil mine which adjoins its Spies mine on the Menominee. The mine was first opened in 1912 and has shipped approximately 200,000 tons of ore to date.

One of the most interesting developments made by the Cleveland-Cliffs company was the completion of its two concrete shaft houses at its Cliffs Shaft mine, Ishpeming, a preliminary description as to details of which was presented in the 1920 annual issue of THE IRON TRADE REVIEW.

Interests identified with Pickands, Mather & Co., have taken over the lease of the Zenith mine on the Vermilion range, formerly operated by the Oliver Iron Mining Co. The mine was opened in 1892 and approximately 6,000,000 tons of ore have been shipped. Pickands, Mather & Co., also have taken over the Porter, formerly the Amasa-Porter, on the Menominee. This mine formerly was controlled by the Nevada Mining Co., but recently was acquided temporarily by M. A. Hanna & Co. Pickands, Mather & Co. opened the Baltic mine which was idle for several years and also the Fogarty, adjacent thereto. Both these mines are on the Menominee range. Considerable drilling was done on the range during the past year by most of the companies owning or operating mining properties.

In connection with its usual development work, the Oliver Iron Mining Co., prepared to open the Frazer mine, covering an area of 80 acres, just east of the Shenango mine, near Chisholm, the fee of which is owned by the Burt estate. Two million cubic yards of overburden will be removed, and it is expected that ore will be shipped in 1922. The company sunk the shaft at the Soudan mine, Tower, Minn., Vermilion range, to the 1800 foot level. This was the first underground mine opened in Minnesota and since 1884 has shipped approximately 9,500,000 tons.

At the Mahnomen open pit, Ironton, Minn., Clement K. Quinn & Co. took over the stripping and loading contract, and all the equipment as well as the property, and now are doing all the work. Stripping was carried on throughout the summer in connection with ore loading. Shipments amounted to 146,000 tons for the season, iron and manganiferous ores. New developments consist of driving along exploratory drifts southward into the pit from the Mangan property. Stripping is proceeding in that direction. This company resumed operations in the spring at the Shada mine, Nashwauk, the mine and concentrating plant being operated throughout the season. The Madrid mine at Virginia remained idle throughout the season, while

Shipments by Ports and Railroads

Gross Tons

	1920	1919
C. & N. W., Escanaba...	4,967,605	3,410,005
C. M. & St. P., Escanaba.	2,393,465	1,553,353
D. S. S. & A., Marquette.	704,017	634,087
L. S. & I., Marquette...	2,711,091	1,498,848
C. & N. W., Ashland....	6,858,327	4,866,240
Soo Line, Ashland.....	1,322,525	1,049,143
G. N., Superior.....	12,685,230	9,114,214
Soo Line, Superior.....	1,475,693	1,263,503
N. P., Superior.....	651,475	542,248
D. M. & N., Duluth....	15,479,334	16,821,209
D. & I. R., Two Harbors.	9,278,464	6,424,545
Totals	58,527,226	47,177,395

NEWEST CONCENTRATING PLANT ON THE LAKE SUPERIOR RANGES, BUILT IN RECORD TIME AT THE HILL-TRUMBULL MINE, NEAR HIBBING

ZENITH MINE AT ELY, MINN., VERMILION RANGE, RECENTLY TAKEN OVER BY INTERESTS IDENTIFIED WITH PICKANDS, MATHER & CO.

the Wisstar mine at McKinley was operated at capacity throughout the season. Shipments were 52,000 tons.

The company conducted exploration work on some Langdon-Warren lands in Section 11-56-23 which were drilled in 1906, disclosing a large body of possible wash ore. Its work consisted of sinking seven deep test pits and is still in progress. The Rolling Mill mine at Negaunee, Marquette range, was operated at capacity throughout the season. Shipments were 285,000 tons; about 40,000 tons of this being siliceous ore from the open pit siliceous operation on the property. Operations are continuing at capacity. The company is doing some exploratory work with a diamond drill underground. The lease on the property was extended in June for 20 years from 1925.

One of the most interesting features of the year from the standpoint of some of the operators was the continual increase in the consumption of maganiferous ore, and with the Minnesota tax commission having made substantial concessions to the operators on the Cuyana, the outlook for them is brighter than it has been in some time. During the past year, however, exploration was practically at a standstill. The only new shipper in the district was the Portsmouth mine producing a manganiferous ore, which was developed in 1918 and 1919, and the only new development was that of the Maroco mine of the Marquette Ore Co., in Section 4-26-29. On this property a shaft was sunk, a washing plant built and the stripping of an open pit begun. Practically all of the producing mines of the main producing district of the North range, as it is called, lying between the Rowe mine at Riverton and the Kennedy mine at Cuyuna, produced at a normal rate and the total production was approximately 2,127,168 tons as compared with 1,861,165 in 1919 and 2,478,800 in the range's banner year of 1918.

The open-pit work at the Armour No. 1 of the Inland Steel Co., has been completed, and preparations have been made to continue production from this property by underground methods. Active mining work will probably not be started before spring. At the Armour No. 2 of the Inland Steel Co., at the Meacham mine of the Rogers, Brown Co., at the Cuyuna-Duluth mine of the American Manganese Mfg. Co., and at the Bonnie-Bell mine of the Liberty Mining Co., the shafts were sunk to deeper levels during the year.

At the beginning of the year the Thompson mine of the Inland Steel Co., was abandoned and at the close of the year the Rowe mine of the Pittsburgh Steel Co., also was abandoned. Both of these mines were among the earliest developed on the range and with the ore bodies nearing exhaustion the leases have been surrendered.

In the manganiferous ore district to the north of Crosby and Ironton practically all of the small underground properties, which were closed in the few months succeeding the announcement of the armistice, have remained idle with the exception of the Merritt mine, which operated for a few months during this year. Practically all of the stockpiles of manganiferous ore were shipped in 1920 and a considerable tonnage was produced by three open pit manganiferous ore properties, Portsmouth, Mahnomen and Sagamore mines. With the closing down of the Omaha mine at Woodrow there remained no operating properties on the South Cuyuna range.

The Croft mine of John A. Savage & Co., on the Cuyuna was operated continuously, shipping approximately 154,000 tons during 1920. The new 333-foot bottom level is nearly complete and the development in ore has been satisfactory. The drifting and raising between the 333-foot level and the old 222-foot level is entirely in bessemer ore, said to be running from 60 to 69 per cent in iron. The Sagamore mine of John A. Savage & Co. was considerably enlarged and 65,000 tons of ore shipped. Next spring a screen-

THIS 300-TON ELECTRICALLY OPERATED SHOVEL, NOW ENGAGED IN STRIPPING AT THE HANNA ORE MINING CO.'S WABIGON MINE, MESABI RANGE, HAS A 150-FOOT BOOM AND 5-YARD BUCKET. FOR MINING, THE BOOM WILL BE 80 FEET AND THE DIPPER OF 6 YARDS CAPACITY

FIVE TO SIX MILLION TONS OF OVERBURDEN WILL BE STRIPPED FROM THE BOEING MINE, AT HIBBING, MINN. NOTE THE CHUTE BY WHICH THE 300-TON SHOVEL IS FED WITH COAL

ing and drying plant will be erected on the south bank of the pit to treat the entire output. Although the open pit is shallow it has been decided not to haul the ore through an approach in trains, but to hoist in skips up the bank of the pit from a large pocket in the central part of the south side. This will permit a gravity screening and drying operation. The plant will have a capacity of 4000 tons per day. The ore body, which is the largest manganiferous deposit in the world, is peculiar in that its manganese content varies from 5 to 30 per cent directly with the size, the manganese increasing as the size increases. In its crude state it is very coarse and the screening operation is purely for crushing and grading purposes.

The company has begun the construction of a group of buildings on this property, which will be the purchasing, mechanical and clerical headquarters for its operations. A fireproof warehouse and office building is now complete, and a substantial machine shop, blacksmith shop and electrical repair shop will be erected in the spring.

Much interest is manifested in what Henry Ford is to do in developing the Imperial mine which he acquired with 400,000 acres of land in northern Michigan. This mine, located near Michigamme on the Marquette range, was first opened up in 1882 and was operated by the Cleveland-Cliffs Iron Co., which surrendered its lease to the Michigan Iron & Land Co. The mine has produced 363,533 tons of non-bessemer limonite, while the Michigan tax commission estimates it contains 1,500,000 tons of merchantable ore. Mr. Ford reopened the mine last year and it is understood that other portions of the land he acquired will be explored.

The Steel & Tube Co., of America has taken over the Isabella mine, about five miles south of Negaunee, on the Marquette range, formerly operated by the Cascade Mining Co. The Morrow mine, Mesabi range, which has been idle since 1902 has been taken over by the Kingston Mining Co., and will be operated in 1921.

Increasing ore shipments are reflected in the plans for enlarging the capacity of some of the ore docks. The Chicago & Northwestern railroad is lengthening dock No. 3 at Ashland 1000 feet, thus increasing the number of pockets from 200 to 340 and bringing the storage capacity up to 213,000 tons. By far the greater part of the tonnage from the Gogebic range moves through the Chicago & Northwestern docks and constantly growing shipments from that range have made additional handling facilities imperative.

The Soo line is to build a new ore dock at Superior, more than doubling its capacity. This dock serves the Cuyuna range.

Utilizing Low-Grade Ores

(*Concluded from page 37*)

dinary use is in the introduction and mixing of the fuel. This is done while the concentrate still is fluid, before it goes to the filter, thus greatly reducing the investment and operating cost. This is a patented method which was demonstrated to be of practical worth in the company's preliminary experiments.

The percentage of phosphorus is under close control in the washing process. The sinter carries only traces of sulphur and titanium with silica between 6 and 10 per cent and alumina, lime, magnesia and manganese each below 1 per cent of the entire product. As tried out in a furnace practice by the Midvale Steel Co., it is said to have reduced the consumption of coke while increasing the productivity of the furnace.

The power plant will consist of four Edgemore boilers in conjunction with two General Electric turbines of 2000 kilowatts each, while a complementary of the plant will be a machine shop for the handling of general repairs.

Build Town As Well As Plant

Simultaneously with the work done on this first unit it was necessary to build living and working quarters, as well as a considerable amount of railroad trackage, eight miles of which are owned by the company. The town was situated on the crest of a granite hill and much of the two miles of water pipe was exposed, so that it became necessary to run a steam pipe along part of its length to prevent freezing in winter. W. G. Swart, the general manager of the company, lives in a cottage at the camp; there is a school for the children and comfortable quarters for all. As the mining enterprise develops Babbitt may rival some of the larger towns of the range. A permanent site is to be chosen a short distance from the present location.

The ore to be shipped from Babbitt will be handled through some established selling agency. Now that the future outlook is encouraging the inevitable reports and conjectures as to what is to become of Babbitt, and who eventually is to own or control are heard everywhere on the ranges. The most common comment is that Hayden, Stone & Co., are financiers, and not iron miners or furnace operators and that some large consuming interests whose own supplies are not in keeping with its consumptive demand must take it over. Be that as it may, some of the leading interests are known to be in close touch with the developments; they express the desire to see the project succeed. "It is a wonderfully big undertaking," they say, so big, in fact, that if it develops in accordance with expectation there would be but one or two companies so situated that they could handle it.

Motor Car Factor Overestimated

Consumption Appears Insignificant When Compared with Steel Mills' Total Output—Only 3.5 Per Cent of Rolled Product Used at Floodtide of Automobile Production in 1919—Relationship to Steel Industry Analyzed

BY JOHN W. HILL

SWEEPING curtailment in the production of automobiles and recent announcements of sensational price reductions based on "anticipations of cheaper raw material costs", have centered attention in the steel trade upon these three questions:

What is the relative importance of the automotive industry as a consumer of the iron and steel product?

What will be the probable ultimate effect of curtailment of automobile production upon the iron and steel market?

To what extent can automobile price reductions be absorbed by lowering the cost of iron and steel used in their manufacture?

The whole problem has been confused by the meteor-like growth of the automobile industry, together with its spectacular bidding-up of quotations of certain steel products during the past year. This has led many observers into the natural error of overestimating the importance of motor car manufacture as a factor in the iron and steel market.

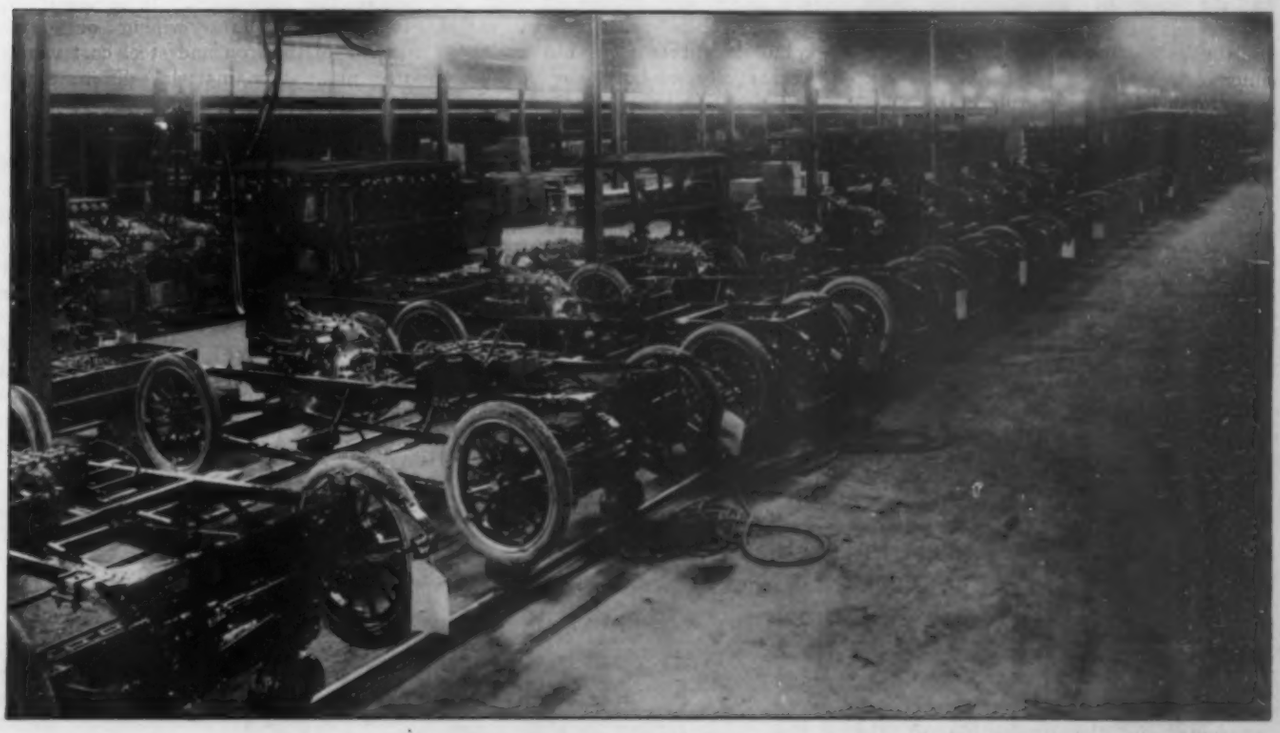
Careful investigation and analysis of the facts show that the automobile demand has been a dominant market influence only in certain restricted spots of the iron and steel industry. Consequently the direct effect of a smaller output of cars upon iron and steel prices would be confined to those special areas.

Percentage Small

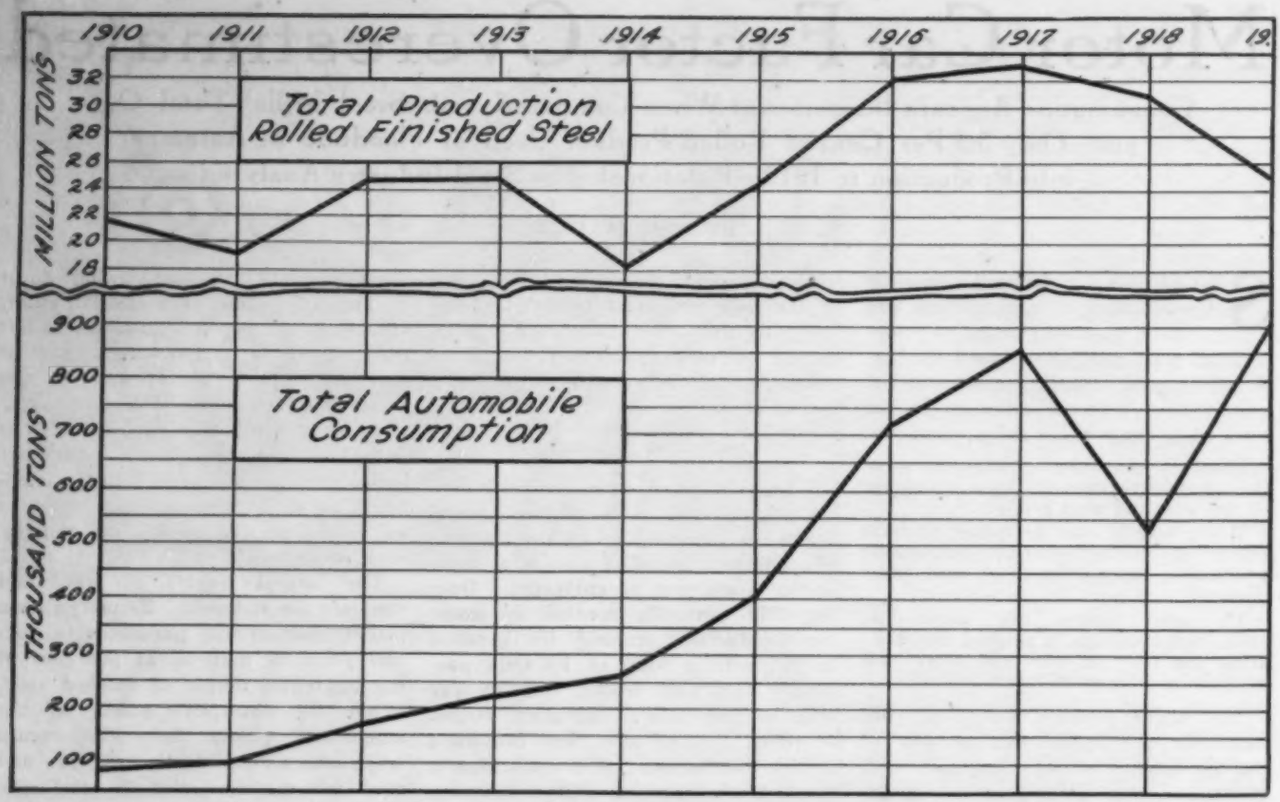
When compared with the total output of all steel mills of the United States the consumption of the automobile industry dwindles into a percentage of surprising insignificance. During 1919 when the floodtide of motor car production attained its greatest height, with a total of 1,974,016 passenger cars and trucks, but 3.5 per cent of the year's aggregate output of rolled finished steel was consumed in this manufacture. It is doubtful if it reached this figure in 1920 considering the sharp retrenchment of the automobile plants during the second half.

From these facts it would seem clear that the consumptive capacity of the automotive plants scarcely is sufficient to exert far-reaching influence upon the iron and steel industry as a whole. This is because the general consumption of iron and steel is so diversified that the slowing down of any single line of industrial effort, excepting possibly the railroads, is not reflected to any important degree in mill and furnace operations. At the same time, recessions of business usually are general and not confined to individual lines of industry. For that reason the iron and steel industry interlaced as it is with various branches of production, is quickly affected by such conditions.

The largest buyers of iron and steel are the railroads. Estimates have placed their annual purchases in normal years as high as 33 per cent of the aggregate output of finished steel. While the absorptive power of the automobile plants lacks importance when compared with the total iron and steel tonnage demanded by the railroads or by the country at large, it is true that at some points continuous operations and healthy earnings are dependent wholly, or in a considerable measure, upon the prosperity of the automotive industry. This refers to steel products manufactured in the form of highly finished sheets, hot and cold rolled strip steels and alloy steels.



ASSEMBLY TRACK IN A LEADING DETROIT AUTOMOBILE PLANT WHICH WAS A TYPICAL SCENE DURING THE RECENT HIGH-PRODUCTION PERIOD



TOTAL PRODUCTION OF ROLLED FINISHED STEEL IN THE UNITED STATES COMPARED WITH ESTIMATED TOTAL CONSUMPTION IN MANUFACTURE OF AUTOMOBILES, 1910 TO 1919, INCLUSIVE

As the manufacture of motors cars expanded, the logical result has been a concurrent growth of sources of supply which would meet its highly specialized needs. The steel industry has rapidly adjusted itself to the newcomer in the field of manufacturing with the result that numerous important mills now are devoted to supplying the automobile trade with special and high grade types of material. It is these specialized plants which have felt most keenly the sharp decrease in the quantities of steel still consumed by the automobile builders.

Quantities of Metals Used

In 1918 the war industries board requested from the National Automobile Chamber of Commerce information regarding the quantities of metals used in the making of automobiles. According to the data supplied the governmental body by the statisticians of the automobile organization, the average motor car requires in the way of iron and steel:

200 pounds of steel in bars and billets.
113 pounds of steel springs.
500 pounds of steel sheets.
100 pounds of alloy steel.
630 pounds of malleable and foundry pig iron.

The total of iron and steel products consumed in the production of the average automobile therefore, it is shown, is 1543 pounds. Of steel alone the amount is 913 pounds and of pig iron about 630 pounds.

It is impossible to calculate exactly the cost of the iron and steel which goes into an automobile. Many different kinds and grades of steel are used and costs are just as varied. Automobile sheets were bid up above 15 cents a pound at the height of the buying movement last spring. On the other hand, prices of the United States Steel Corp. have stood unchanged at 4.35 cents per pound for plain black sheets since March, 1919. The usual differential over ordinary black sheets for highly finished sheets suitable for body, fender and radiator stock is from $1 to $1.50 per 100 pounds. For blue annealed sheets used for frames the Steel corporation's price was 3.55 cents. Approximate estimates place the cost of the steel used in automobiles at around 6 cents a pound. This would mean that the cost of the plain iron and steel going into the average motor car stands well under the $100-mark. It is apparent, therefore, that the wiping out altogether of the iron and steel cost would not make any material difference in the price of a $2000 or $3000 car.

Rolled Steel Consumed

Year	Production	Consumption	Per cent
1919	5,825,000	621,745	10.6
1918	6,080,069	363,395	5.9
1917	6,200,521	588,719	9.4
1916	6,394,682	498,839	7.7
1915	5,631,632	281,174	5.0
1914	5,064,860	179,249	3.5
1913	6,074,193	147,775	2.4
1912	5,825,000	119,070	2.0
1911	5,012,000	66,150	1.3
1910	6,043,000	58,985	0.96
1909	5,900,000	40,125	0.66
1908	3,961,000	20,475	0.51
1907	5,990,000	13,860	0.23
1906	4,993,000	10,710	0.21
1905	5,325,000	7,875	0.14
1904	4,025,000	6,930	0.17

Proportion of Output Consumed

In 1919 iron and steel production was at low ebb, due to the steel and coal strikes. The output of automobiles then was the highest ever achieved in one year. Based on the data supplied by the automobile chamber of commerce, a study made by THE IRON TRADE REVIEW, covering the most important materials going into automobile production, shows that in 1919 there was consumed approximately in the manufacture of motor cars:

27.1 per cent of the total output of black sheets, 13 gage and thinner.
13.4 per cent of the total production of all black sheets.
6.8 per cent of the alloy steel output.
10.6 per cent of the total foundry and malleable pig iron production.
3.5 per cent of the total rolled finished steel production.

The growth of the automobile in-

dustry provides one of the most striking stories of a great industrial age. Its development is vividly mirrored in the record of its annual consumption of iron and steel. In 1904 when the business of making motor cars still was in its infancy, those manufacturers purchased and used only 10,048 tons of rolled finished steel. This was 0.08 per cent of the total of 12,013,381 tons of finished steel which represents the aggregate production of the rolling mills of the country during that year.

In 1919 the automobile industry manufactured 1,974,016 passenger cars and trucks, consuming in the process an estimated total of 901,138 tons of rolled finished steel. This shows an increase of 8868 per cent over 1904. Yet the percentage of the total steel output going into cars was only 3.5 per cent. This was due to the vast expansion in iron and steel capacity which has taken place in the span of 16 years. In 1919, notwithstanding the serious handicaps surrounding operations, the country's mills rolled 25,100,000 tons of finished material, a gain over 1904 of 108 per cent.

Next to 1919 the highest point in automobile production was reached in 1917 when the total of passenger cars and trucks completed was 1,868,947. In that year it is estimated 853,174 tons representing 2.2 per cent of total output of 33,067,700 tons of rolled steel were used in the building of automobiles. In 1916 the estimate is 722,421 tons or 2.2 per cent of the total output of 32,380,389 tons of rolled steel.

Greatest Demand for Sheets

Analysis confirms what general market knowledge had established, that the automobile has made its greatest demand upon sheet production. In 1919, the automobile consumption was about 493,504 tons of black sheets of 13 gage and thinner, or 27.1 per cent of the total production. In 1918 when steel outputs were concentrated on war needs, and automobile production was kept in check, consumption of sheets from the latter source was only 17.3 per cent of total output. In 1917 it was 23.4 per cent and in 1916 it was 20 per cent.

Harking back to the early period of the motor business in 1905, only 6250 tons, or 0.6 per cent of the black sheet production was consumed. This ratio grew slowly until 1913 when it leaped to 8.5 per cent from 5.2 per cent the year before. In 1914 it was 10 per cent and in 1915 it was 13 per cent.

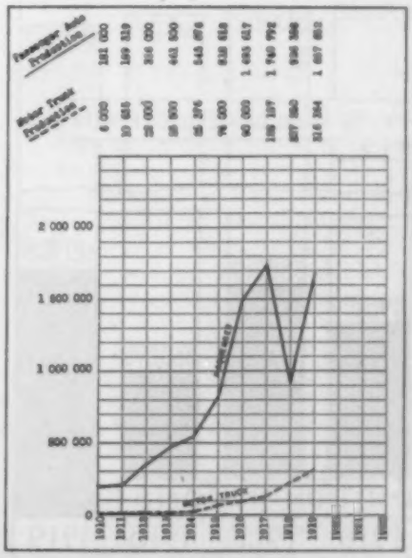
Responding to this expansion of demand a notable enlargement of sheet mill capacity of the country was witnessed. During 1919, 22 sheet mills

Sheet Steel Consumed

Year	Production	Consumption	Per cent
1919	1,818,000	493,504	27.1
1918	1,657,843	288,409	17.3
1917	1,992,712	467,237	23.4
1916	1,971,870	395,904	20.0
1915	1,661,801	223,154	13.0
1914	1,258,626	127,261	10.1
1913	1,424,724	121,250	8.5
1912	1,821,366	94,500	5.2
1911	1,318,345	52,500	3.9
1910	1,385,157	46,750	3.3
1909	1,109,157	31,750	2.8
1908	845,501	16,250	1.9
1907	1,044,100	11,000	1.5
1906	1,091,977	8,500	0.7
1905	1,010,321	6,250	0.6

with an annual producing capacity of 50,000 each were completed, and at the beginning of 1920, a total of 87 mills was under construction. From 1905 to 1919 black sheet production gained 80 per cent. Stimulation of demand by automobile makers furnished the first sign of returning activity to the sheet mills and to the steel industry in general in the dull days immediately following the armistice.

The growth of consumption of foundry and malleable iron in automobile castings has been a development of major importance in the foundry field. This has resulted in a tremendous spurt of foundry expansion which is estimated at between 25 and 33 per cent in the last 18 months. During the last few years the foundry industry of the country has fluctuated within comparatively narrow limits. The peak of malleable and foundry iron output in the prewar days was reached in 1913 with a total of 6,074,193 tons. This exceeded the 1919 output of 5,816,462 tons. In 1913 the motor car trade, it is estimated, used only 147,775 tons of pig iron or 3.5 per cent of the whole production. This had grown to 621,745 tons or approximately 10.6 per cent of the entire output in 1919.



PASSENGER AUTOMOBILE AND MOTOR TRUCK PRODUCTION IN THE UNITED STATES SINCE 1910 COMPARED

Although alloy steel is much in demand in the manufacture of automobiles, the total consumption is not large. Only 100 pounds, it is figured, goes into the average car. In 1919 automobile plants, it is believed, used about 98,700 tons of alloy steel. This was 6.8 per cent of the total production. In 1909 but 6386 tons or 0.4 per cent of the total output was consumed.

Consumption of Nonferrous Metals

In the nonferrous metals it is estimated that 130,000 tons of lead for storage batteries and for other parts was used by automobile manufacturers and by auto owners in making battery replacements in 1919. This lead in batteries, solder and other alloys, was 27 per cent of the total lead production of 485,000 tons in that year. Active lead buying on account of the automobile activity last year is indicated by the rise of prices to 9.25 cents a pound in April over the low point of around 5.50 cents following the armistice. Since the slump in the automobile industry, lead prices have been falling.

The automobile is a small factor in the copper industry. The average use of the red metal in a single car is 36 pounds. In 1919 automobiles consumed only about 4 per cent of the total copper refined. Most of the copper consumed is in the form of brass; some of it cast. The greater portion of it is rolled or drawn, as sheets for radiators, lights and tubing. It is estimated that approximately 75,000,000 pounds of brass or around 7 per cent of output appeared in finished automobiles made in 1919.

The use of zinc in automobiles is said to average about seven pounds a car. This metal does not enter into construction to any appreciable extent as zinc, but is included in the brass. At the rate given, about 1.5 per cent of the refined output of this metal last year entered into cars. Aluminum, above all other metals, is distinctly an automobile material. Exact figures on this metal are not obtainable, as neither the government nor the sole producer of new metal in this country, gives the information. The automobile chamber of commerce has not estimated the amount of this metal used in each car, as with other metals. However, from certain reports and trade conditions it is estimated that the annual output of aluminum is around 120,000,000 pounds and about one-half of this amount is used in automobile castings and sheets. In addition, a fair tonnage of this metal is used in deoxidizing steels which are used in the manufacture of automobiles.

The tin used is estimated to be 7.5 pounds on the average car, this metal being used to plate radiator parts, and is used in alloys such as solder, babbitt and bronze. At the rate mentioned about 13 per cent of the tin imported as ore and as pig metal into the United States in 1919 entered into the building of automobiles.

About 10.5 pounds of manganese is represented in the average automobile, most of it probably for deoxidizing steel. At this rate about 4 per cent of the total manganese supply contained in manganese alloys produced and imported into the United States last year went into the making of motor cars. This figure would appear to be a liberal estimate and the true amount may be less, as the figures are indefinite, it is not clear whether the 10.5 pounds refers to the metallic manganese content of alloys or to manganese alloys in bulk.

In considering the effect of the automobile industry upon the iron and steel markets no estimate can be made of the vast amount of steel which has gone into new machinery and expansions of motor car and accessory plants. This phase of the situation was of tremendous importance during 1919 and early in 1920. The tire industry alone has grown by leaps and bounds, and enormous quantities of steel for building and for new machinery has been absorbed. A great number of accessory concerns, big and little, also have sprung up. It has been said that the accessory and the automobile industry, itself, in point of size, capital involved and labor employed.

Alloy Steel Consumed

Year	Total output	Automobile consumption	Per cent
1919	1,434,000	98,700	6.8
1918	1,721,367	57,681	3.3
1917	1,576,806	93,447	5.9
1916	1,306,157	79,180	6.0
1915	923,251	44,630	4.7
1914	577,107	28,452	4.9
1913	625,430	24,250	3.8
1912	689,392	18,900	2.7
1911	425,169	10,500	2.4
1910	538,462	9,350	1.7
1909	158,978	6,386	0.4

In 1919 the number of motor vehicles produced in the United States was 1,974,016. Of these 1,657,652 were passenger cars and 316,364 were trucks. The record in 1919 represented an increase in passenger car production of 78.94 per cent over that of 1918. But 1918 was a war year and automobile manufacturers were forced to curtail output in order to release labor and materials for war work. As a result the total output slumped 46.78 per cent from the 1,740,792 passenger cars made in 1917. During the 7-year period ending with 1917 the average annual increase in motor car production was over 37 per cent.

The aggregate wholesale value of cars and trucks produced in 1919 was $1,885,112,564. If to this figure is added the value of extra parts accessory and tire replacements for the year, the grand total would reach $3,166,834,594. The total number of passenger cars in the United States in 1919 was 6,808,848; the number of motor trucks 750,000, making a total of 7,558,848 an increase of 23 per cent over 1918. At the present time there is one car to every 14 persons in the United States. The vast growth of the automobile industry including parts and accessories plants since 1899 is portrayed in the accompanying table.

Growth of Automobile Industry Since 1899

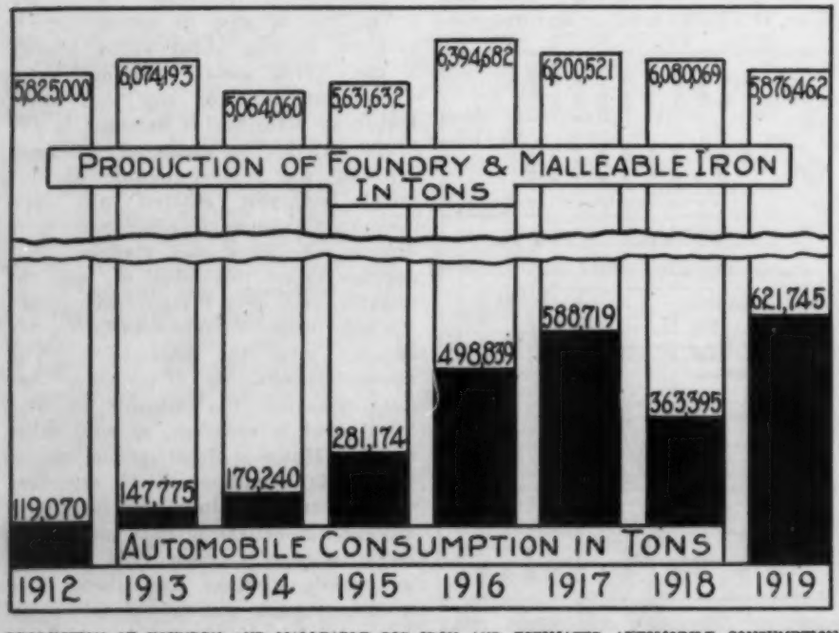
	1899	1904	1909	1914	1919
Capital invested	$5,769,000	$23,084,000	$173,837,000	$407,730,000	$1,802,302,862
Motor vehicles produced	3,700	21,975	127,731	569,045	1,974,016
Value of products	4,748,000	30,034,000	249,202,000	632,831,000	2,506,834,594
Number persons engaged	—	13,333	85,359	145,951	651,450
Wages and salaries	1,616,000	8,416,000	58,173,000	139,453,000	813,731,856

What of the future of the automobile? When the demand for cars first began to diminish some months ago an impression gained ground among manufacturers that they were being made the victims of a gigantic bankers' conspiracy. Subsequent events have proven this a mere illusion. Like most lines of manufacture the motor industry is undergoing readjustment. Because of its rapid expansion and methods of financing, the motor trade was among the first to feel the effects of general deflation and its readjustment undoubtedly is more severe than occurred in most lines.

The automobile has won a fixed place for itself in modern life, however, and there is no danger of a breakdown in the industry as a whole. A picture of the automobile industry was painted at a recent meeting of the Motor and Accessories association by an official of a steel company which supplies steel for parts. He said:

"The automotive industry has overreached itself. It forced sales through easy credits. Then it proceeded to expand in the apparent belief that this extravagant abnormal demand was a permanent thing. Its resources were tied up in brick and mortar and in excessive inventories. When inflation halted, the automobile manufacturers found there was an over-production of many makes of cars. Readjustment will clear away the deadwood for the business. Receiverships and consolidations will appear. But when the readjustment is completed and activity is resumed, I believe the industry will be on a healthy basis. Competition will be strong and for that reason good cars at reasonable prices must be made."

The plan of selling cars by manufacturers for cash has been criticised by some. In order to aid the sales of



PRODUCTION OF FOUNDRY AND MALLEABLE PIG IRON AND ESTIMATED AUTOMOBILE CONSUMPTION IN THE UNITED STATES, 1912 TO 1919, INCLUSIVE

cars to individual buyers commercial finance houses have been developed. These houses finance a sale by dealers on the installment plan. During the inflation period when wages and incomes were going up sales were made on a 20 per cent down payment with 12 monthly installments. This brought automobiles within the reach of thousands, many of whom could not afford the luxury of cars. It is said that between 50 and 75 per cent of medium priced cars sold in 1919 were on credit. Since the beginning of 1920 terms have been tightened. A down payment of 35 per cent now is required and the deal must be closed for 10 months. Furthermore credit applications are scrutinized much closer than at any time during 1919 or in the early part of 1920.

2,000,000 *Cars Built in* 1919

The 1919 production reached almost 2,000,000 passenger cars and trucks. At the beginning of the present year manufacturers optimistically fixed a goal of nearly 2,500,000 cars. During the first six months it is estimated that 1,000,000 cars were made, operations were hampered somewhat by the railroad strike and the difficulty of obtaining raw materials. At the presen time, under conditions making for a shrinking demand, production is severely curtailed. Few plants are still running at capacity and the majority are estimated to be operating from nearly zero to around 50 per cent of capacity.

The probable normal demand for cars after the readjustment period is completed, is occupying the serious study of manufacturers. In 1913 a total of 461,500 passenger cars were made and sold. With probably 9,000,000 cars in the country now it is evident that the replacement sales alone will be large. Some place this as high as 1,000,000 cars annually. A number of experts in the trade believe that the normal demand will settle down to from 1,200,000 to 1,500,000 cars annually. This would mean an annual consumption of about 925,000 to 1,150,000 tons of iron and steel.

Some students of business conditions are predicting a period of hard times for the automobile industry. The hothouse conditions recently existing have incubated a total of more than 130 plants constituting a productive capacity which seems above all possible consumption in the opinion of many. Recent price reductions have not greatly quickened sales, generally, reports indicate. In foreign countries automobiles are comparatively few and the European demand for American cars has been large. But decreased buying and industrial depression abroad together with demoralized exchanges are combining to curtail this traffic also.

Although the automobile industry has grown vastly since 1910 and Detroit has been the chief center of the growth, there are 11 less automobile and truck plants in that city now than 10 years ago. In 1910 the number of companies was 31 while at the present time there are 20. Detroit manufacturers of trucks and passenger cars at present include the Cadillac Motor Car Co., the Chalmers Maxwell Co., Columbia Motors Co., Detroit Electric Car Co., Dodge Bros. Co., Hudson Motor Car Co., Hupp Motor Car Corp., King Motor Car Co., Scripps-Booth Co., Liberty Motor Car Co., Lincoln Motor Co., Locomobile Co., Saxon Motor Car Co., Packard Motor Car Co., Paige-Detroit Motor Car Co., Commerce Motor Car Co.; Denby Motor Truck Co., Federal Motor Truck Co., Standard Motor Truck Co., and J. C. Wilson Co.

More Mergers Expected

The contraction of the number of companies, affected both by elimination of some plants and merger of some others, is a process which may be expected to be more pronounced within the near future than in recent years.

The tendency at the present time is toward further consolidations in the automobile industry and the bringing of units into strong financial hands. That great financial interests have faith in the ultimate stability of the motor industry is evident from the backing that is being given to larger companies which are in temporary financial difficulties due to heavy inventories purchased at high prices to meet an enormous demand for cars, which suddenly stopped. The most notable example of banking intervention in the affairs of a motor company is the recent move of the Morgan and DuPont interests in acquiring control of the General Motors Corp.

Pig Iron Consumed

	Total production	Automobile consumption	Per cent
1919	25,100,000	901,138	3.5
1918	31,155,754	526,635	1.6
1917	33,067,700	853,174	2.2
1916	32,380,389	722,421	2.2
1915	24,392,924	407,485	1.6
1914	18,370,196	259,769	1.4
1913	24,791,243	221,402	0.88
1912	24,656,841	172,557	0.69
1911	19,039,171	95,865	0.5
1910	21,621,279	85,365	0.39
1909	19,644,690	58,220	0.29
1908	11,828,193	29,672	0.25
1907	19,864,822	20,086	0.1
1906	19,588,468	15,521	0.07
1905	16,840,015	11,412	0.06
1904	12,013,381	10,048	0.08

Detroit District Produced 1,848,000 Cars in 1920

IN 1910 *with a production of* 179,100 *cars Detroit and vicinity manufactured* 95 *per cent of the total made in the country. In* 1920, *according to figures compiled by Automotive Industries, for* 11 *months combined with an estimate for December, the production in Detroit and Michigan aggregated* 1,848,049 *cars, or an increase of* 932 *per cent in* 10 *years. The estimated production for the Detroit district at the beginning of the year was* 2,487,000 *trucks and passenger cars and the actual output shows a contraction of* 25 *per cent from that schedule. During the first six months of the year production amounted to* 1,072,907 *cars. the peak being reached in January when* 185,510 *passenger cars alone were made. The low point in production of passenger cars in the first half of the year was struck in April at the time of the railroad strike. Then only* 111,961 *cars were made. Singularly enough this month marked the greatest volume of truck output, the total being* 51,299. *The truck record had dropped to* 13,500 *in August. During the last half of the year the total production of cars in the Detroit district was* 775,142. *This was* 27 *per cent less than the actual production attained during the first half of the year and* 37 *per per cent less than the manufacturing schedule outlined early in* 1920. *The production of cars by builders in Detroit and vicinity in* 1910 *is as follows:*

Name	Cars
Anderson Carriage Co., Detroit	1,500
Brush Runabout Co., Detroit	10,000
Buick Motor Co., Flint, Mich.	25,000
Cadillac Motor Car Co., Detroit	25,000
Cartercar Co., Pontiac, Mich.	3,000
Chalmers-Detroit Motor Co., Detroit	6,500
Demotear Sales Co., Detroit	3,000
Detroit-Dearborn Motor Car Co., Detroit	500
E-M-F Co., Detroit	40,000
Ford Motor Co., Detroit	30,000
Grabowsky Power Wagon Co., Detroit	900
Hudson Motor Car Co., Detroit	5,000
Metzger Motor Car Co., Detroit	2,500
Oakland Motor Car Co., Pontiac, Mich.	7,000
Packard Motor Car Co., Detroit	3,000
Paige-Detroit Motor Car Co., Detroit	2,000
Rapid Motor Vehicle Co., Pontiac, Mich.	5,000
Regal Motor Car Co., Detroit	5,500
Reliance Motor Car Co., Owosso, Mich.	1,200
Reo Motor Car Co., Lansing, Mich.	8,000
Sibley Motor Car Co., Detroit	2,500
Warren Motor Car Co., Detroit	2,500
Welch Company of Detroit, Detroit	1,500
Total	179,100

Havana is one of the foreign ports where much American steel is laid down

Can Steel Exports Be Kept Up?

Much Depends Upon the Desire and Policy of American Mills and the Assistance Bankers Are Willing To Give Exporters—Tonnage Record for Past Year Was More Than Good, Analysis Shows

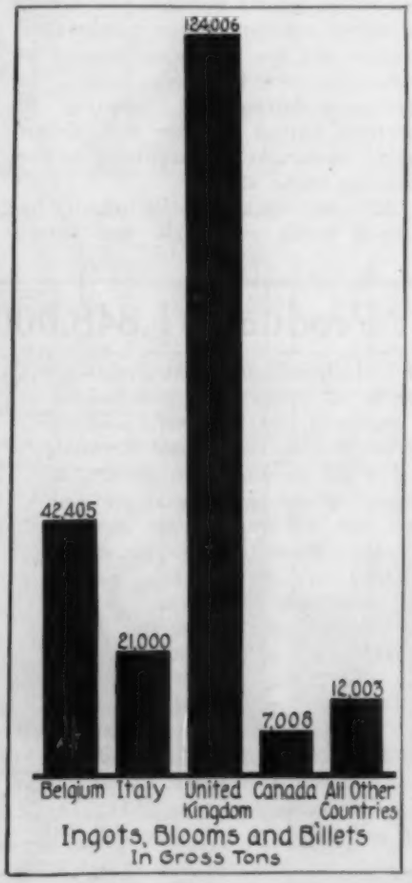
BY V. G. IDEN

POTENTIAL demand is all very well in its way, but American export houses have been finding that very poor fare during the past few months, and they have approached the year 1921 with some trepidation. This is in sharp contrast with the conditions which prevailed just one year ago. With the closing of 1919 the iron and steel industry was passing through one of the worst strikes ever experienced. The first of 1920 therefore saw a condition where the American exporter lacked nothing in the way of demand but found it extremely difficult to provide the supply. Then mill production had improved and increased output was in prospect when the big switchmen's strike occurred in April, and the visible supply went down again.

Both the mills and the railroads worked rapidly to repair the losses caused by the labor troubles and brought up steel production before the end of the year to a healthy state. It was then that the exporters were confronted with more difficulties, in the form of restricted credits and a foreign exchange which threatened to break down completely. The discrepancy in exchange kept away further foreign business and at the same time the mills hastened to work off the old orders they had been holding on their books. The new year therefore finds a number of the exporters' books wiped clean of business.

The trouble arising through the delayed deliveries, bringing cancellations, and later through the discrepancy in foreign exchange, resulting in further cancellations, have all contributed to the worries of the business. Under the circumstances, then, it was not unexpected there would follow a weeding-out process. Failures among export houses have not been uncommon. It was to be expected that the weaker of them would go.

To tide over the period of readjustment required large capital and firm backing. But the troubles in iron and steel exporting appear to have been internal rather than external. The gross tonnage of exports during 1920



was not far behind that of the year previous. Many of the failures among export houses were due to the serious inroads made through the handling of commodities other than iron and steel. Losses have been taken on foods and textiles and other commodities. However general export houses cannot live by iron and steel alone. The net result apparently is that the steel producers themselves now have the field much to themselves. They will have to do their exporting largely themselves or through the few strong general international merchants who have been able to weather the storm.

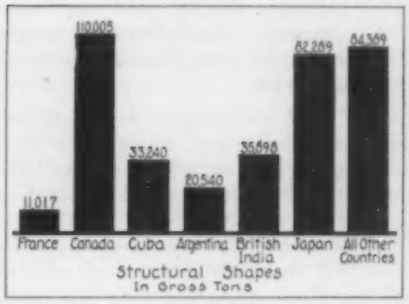
The actual tonnage of iron and steel exported during 1920 will compare favorably with the tonnage exported during 1919. During the late summer and early fall the outgoing shipments were much larger than for the same period the year before, but up to then they had not been so large. The tonnage shipped, however, is not a true index to business placed because the mills were forced to carry forward many orders which had been placed by foreign buyers months earlier. The mills in the summer began to speed up deliveries. They rushed shipments then because they wished to close the orders before the expiration of the letters of credit of the foreign purchasers as the market was declining.

Iron and steel exports in 1918 totaled 5,338,019 gross tons, which, however, included much war business. The next year, 1919, they totaled 4,400,004 gross tons. During the first 10 months of 1920 iron and steel exports had totaled 3,991,367 gross tons. It was therefore evident that the 1920 exports would equal if not pass the 1919 mark. Considered in the light of the industrial

troubles experienced at home and the difficulties encountered in exchange abroad, the record is very good indeed. The trend of both exports and imports by months since 1912 is shown in the curves of the chart at the bottom of this page.

These figures compare more than favorably with the gross exports prior to the war. They do also with the gross exports reported from the other world centers of production. It is believed that they would have been even more favorable had the independent producers shown more interest in co-operating with the independent export houses to build up permanent trade.

One year ago when the foreign demand was tremendous and it was extremely difficult to locate supplies, only small orders were booked. It was at that time that the charge was made that speculators were injuring the business. The manipulations of the speculators were disastrous in the extreme. Some of these booked stocks for export shipment only to sell the materials again when delivered. Those of the speculators who did not actually resell, advanced the prices to their purchasers to keep in touch with the advance in the market. The material,

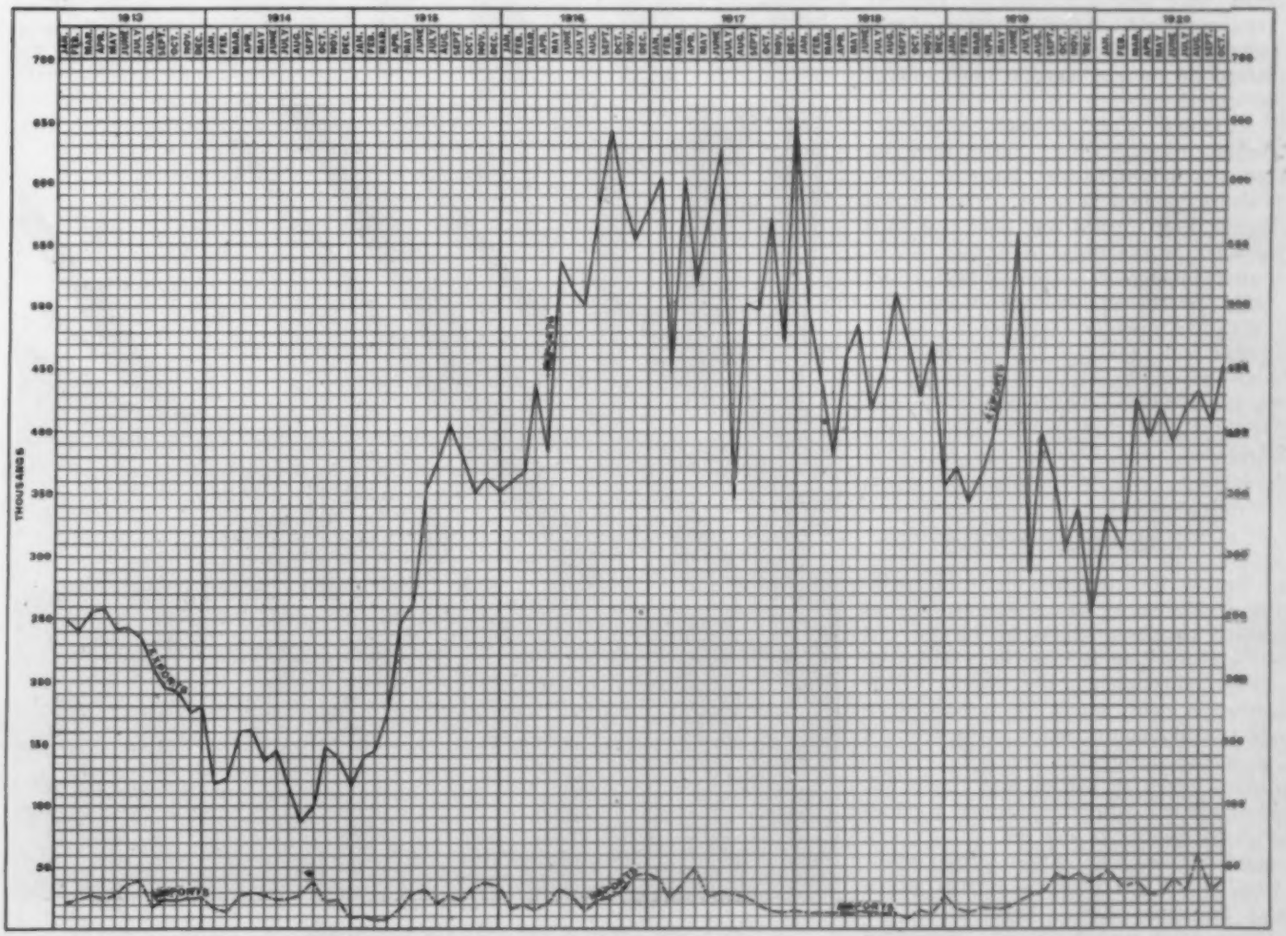


however, was wanted so badly that the foreigners usually took them.

In February, 1920, light material began to disappear from the market. Sheets were especially in demand but it developed that supplies had been contracted for by some buyers, especially automobile builders. Then sales of rails were made and England and Scotland began buying plates and shipbuilding material in the United States. The market was so far sold up by the beginning of the second quarter that foreign buyers were beginning to contract for third and fourth quarter delivery, with prices correspondingly running high.

In April began the switchmen's strike, which further paralyzed the industry. This so far handicapped deliveries that some of the weaker export houses found it impossible to continue in business. A few began to liquidate. In the meantime, however, the larger steel producers in the country were beginning to realize the harm speculators were threatening so they adopted a preferential list of dealers. They would sell only to those dealers who appeared on this list. It contained only these export houses which did a legitimate business, delivered the goods to the purchasers who originally contracted for them, and accepted only the usual commission.

During May, England placed some of her largest ship plate orders in the United States, and Holland and other countries began to buy heavily of rails. Both materials were then lower in price than before and the time was considered propitious for buying. Immediately upon the heels of the development, however, the Japanese panic occurred. Japan's purchasing power had been determined largely by the price of silk. That country was chief exporter of silk and while the price of that article was advancing, it bought heavily abroad. But suddenly the price of silk began to decline and



HOW EXPORT AND IMPORT TONNAGES OF STEEL PRODUCTS HAVE FLUCTUATED EACH MONTH IS SHOWN HERE

Products Exported

Gross Tons

	1920*	1919	1918
Pig iron.....	193,871	321,261	269,575
Scrap	187,528	26,775	2,160
Ingots, billets, blooms	306,416	238,424	1,786,189
Wire rods.....	105,836	118,038	148,501
Steel bars.....	508,356	554,040	579,350
Plates	723,362	382,225	824,457
Sheets	135,439		
Structural shapes	387,378	360,787	232,729
Tin plate.....	190,019	204,531	258,574
Wire	246,877	291,649	392,212
Rails	473,940	652,449	453,537
Pipes & fittings	268,877	275,514	145,986
All products...	3,991,367	4,400,004	5,338,019

*Ten months only.

the drop was so rapid that Japan faced an industrial panic.

The Japanese merchants began to cancel their orders for steel immediately. It was some time before all of this business was cleaned up. After the greater danger was over it was found that Japan had canceled orders for at least 300,000 tons of iron and steel products which were ordered in the Unied States. On some orders the Japanese were compelled to accept delivery. This left an extra large stock of material on hand in Japan to be liquidated. In November last it was estimated that more than 300,000 tons of American iron and steel products, approximately the tonnage canceled here, were still in storage at the chief Japanese ports. A large portion of this represented steel which the buyers were forced to accept despite their desire to cancel.

Troubles with railroad shipments continued in the United States throughout the height of the Japanese panic. Export material in many instances was moved first toward one port and then another in the hope of finding a free outlet to shipside. This added materially to the expense of doing business. By summer the price on export goods had been run so high that foreign buyers began to hold back and to refuse to place their orders. It was said they had become skeptical of the American market since they had been delayed so long in receiving the goods already ordered.

Credits Check Exports

But it was not so much the sold-up condition of the American market which checked exports during the last half of 1920 as it was the credit condition throughout the world. The Japanese panic was a forerunner of industrial difficulties which were destined to spread throughout the world. Coffee prices began to decline and Brazil felt the pinch. Argentina found it difficult to dispose of her hides and grain, and the foreign purchases of that country fell off. Colombian credits began to be questioned. Then came the sugar crash and Cuba was eliminated as a factor in the iron and steel market. Australia found herself cramped for credits and was compelled to cease buying abroad.

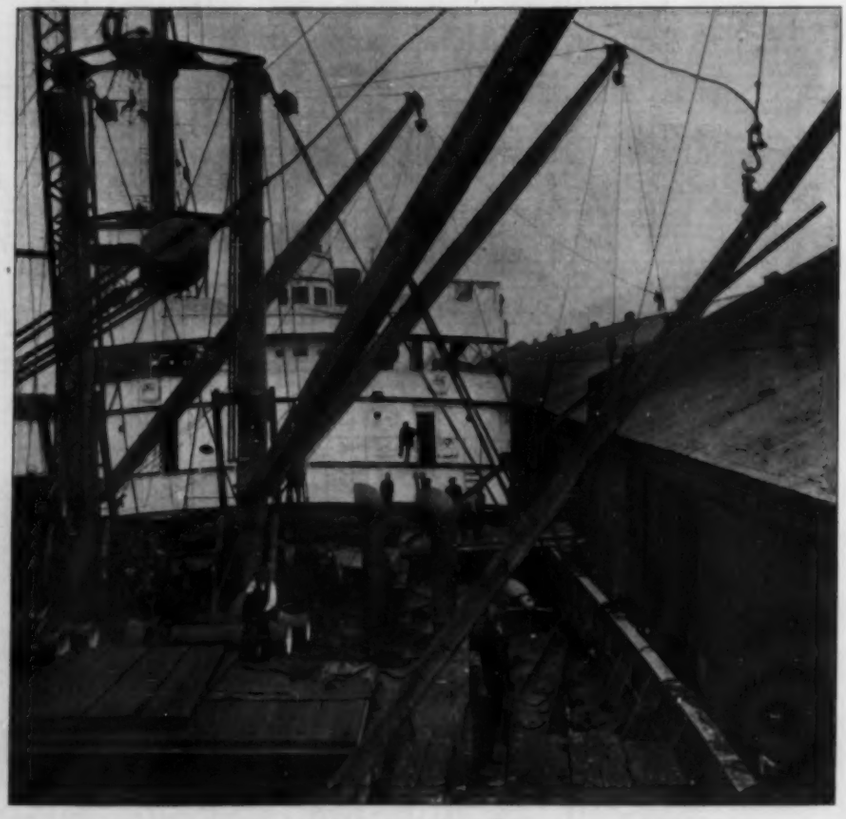
The rapid and constant decline in foreign exchange rates which have been in progress ever since last summer have been the barometer of the industrial conditions abroad. Some of the exporters of shorter vision have been attributing their inability to sell abroad to the disparity in the exchange rates, whereas the exchange has been the result and not the cause of the trouble. Much has been said about the exchange aiding England and other European countries to sell in foreign markets upon much better terms, but that has been only relative. England and Belgium both have been able, by virtue of the exchange, to make quotations on bars, nails and some other products to Cuba, for instance, lower than American prices, but it happens neither England nor Belgium has any large quantity of these products to sell abroad. This foreign competition of American steelmakers, therefore, has been theoretical rather than actual.

An outstanding point is that, while the past year has been extremely trying for the average American export house and the difficulties encountered have not seriously jeopardized the volume of exports of iron and steel, they have at least caused untold losses to those engaged in the business of exporting. During the two years following the signing of the armistice the American iron and steel exporters have been compelled to meet many and constantly changing conditions.

Ten Times More Scrap

In the nature of the 1920 exports there were some interesting changes. The exports of scrap showed a considerable increase, approximately 10 times as much as during 1919. Structural iron and steel and iron bars also showed increases. Foreign sales of ship and tank plates were three times as large as in 1919. More tin plate, wire nails, pipes and fittings, and cast radiators were also disposed of to foreign buyers. On the other hand, decline was recorded in the exportation of pig iron, ingots, blooms and billets, steel rails, sheets, barbed wire and wire products in general, spikes, bolts, nuts, rivets and horseshoes. Exports of wire rods, steel bars, galvanized sheets, cut nails, and hoops were approximately in the same volume as in 1919.

The lighter products were in demand which, it is believed, was based upon emergency repairs and replacements abroad. The buying did not include as much railroad material as in the year before, undoubtedly due to the difficulties encountered in financing railway projects. Building, however, went for-

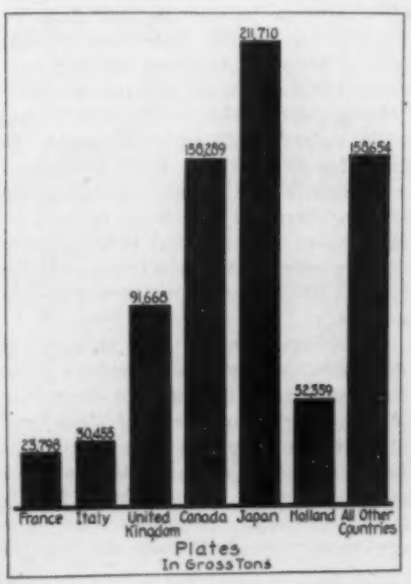


UNLOADING AMERICAN RAILS FOR THE BIRMINGHAM, ENG., STREET RAILWAY

ward as is shown in the sales of structural steel. Railway buying abroad undoubtedly still is held up and much of this will not come out until some practical way has been found for financing the various enterprises. On the other hand there was considerable activity in the ship market during the first half of the year as attested to by the many orders placed in the United States for shipbuilding material. During the last half the demand of the English shipbuilders declined suddenly. This was because of the over-tonnaged market on the part of the British merchant marine.

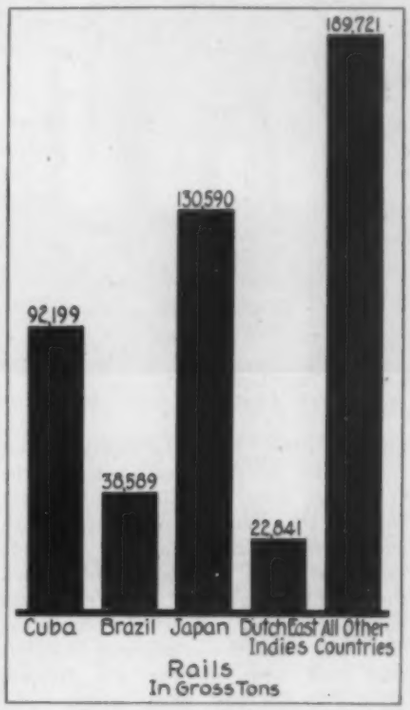
The chief export markets for American pig iron last year were Canada and Italy. Japan too took a good quantity. England's purchases were material although only a fourth of what she bought here in 1919. Principal buyers are shown in the pig iron chart. On the other hand England took by far the larger quantity of blooms, billets and ingots last year and a third more than she purchased in the United States the year before. Belgium and Italy also bought a large quantity of billets of American make last year. The main destinations are shown in the chart on page 50.

Japan took the larger share of the tonnage of steel plates, with Canada and England next in order all three buying heavier than they did during 1919. While the purchases of Italy and France were large they did not equal their purchases the year previous. The tonnage exported to leading buyers in 1920 is shown in a chart on this page. Canada took the larger share of the sales of structural shapes, while Japan, Cuba, Argentina and France came next in order. The purchases of this product by all these countries with the exception of France, were larger for 1920 than for 1919. Principal purchasers are charted on page 51. Japan took nearly twice as many black sheets, while the purchases of Canada during 1920 showed a slight increase. Japan also took the bulk of the 1920 sales of steel rails, after which came Cuba and Brazil, as illustrated below.

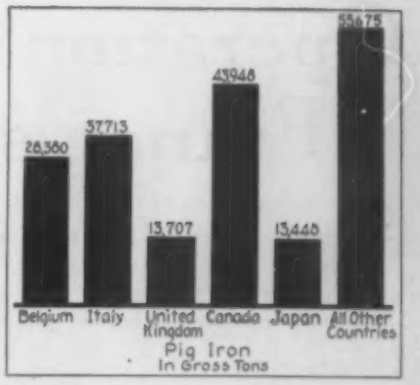


Tin plate sales were chiefly to Canada and Japan. Brazil also took a large quantity in 1920 and so did China. Wrought pipe sales were mainly to Mexico, after which Japan, British India and Cuba ranked in order. Brazil increased her purchases of barbed wire, giving the American makers their chief market for that product.

During the year the United States



Steel Corp. maintained a schedule of prices much lower than the prices charged by the independent producers. It followed therefore that many buyers placed their orders with the Steel corporation mills and took their chances as to when they would receive the material. Consequently the Steel corporation has been carrying on its books for the greater part of the year unfilled orders totaling some 10,000,000 tons of iron and steel. It is said that approximately 15 per cent of this unfulfilled tonnage was intended for export, between 1,500,000 and 2,000,000 tons. It also has been said that the Consolidated Steel Corp., the organization of a number of the larger independent steelmakers, had sold or committed itself to sell approximately 1,000,000 tons. It would appear, therefore, that the bulk of the export sales during 1920, or at least 3,000,000 tons of the sales, have been made through the United States Steel Products Co.,



the Steel corporation export sales organization, and the Consolidated Steel Corp.

At the moment the independent export house is being harassed by the banks as well as suffering from the indifference of the mills. Some are said to have been forced to put up a 50 per cent deposit to obtain a commercial credit from a bank. This may have been an extreme case but it is accurate to say that banking accommodations have been difficult. The situation was brought forceably forward only a few weeks back when William H. Douglass of Arkell & Douglass, 44 Whitehall street, New York, reporting to the New York chamber of commerce, said:

"While we may not be passing through a financial panic we are now in the throes of a commercial one. Our foreign trade is at the mercy of the bankers and they are the weakest link in the chain of export business. Only a short while ago the bankers and other high authorities of the nation urged us to go into the foreign field and promised us help to the limit.

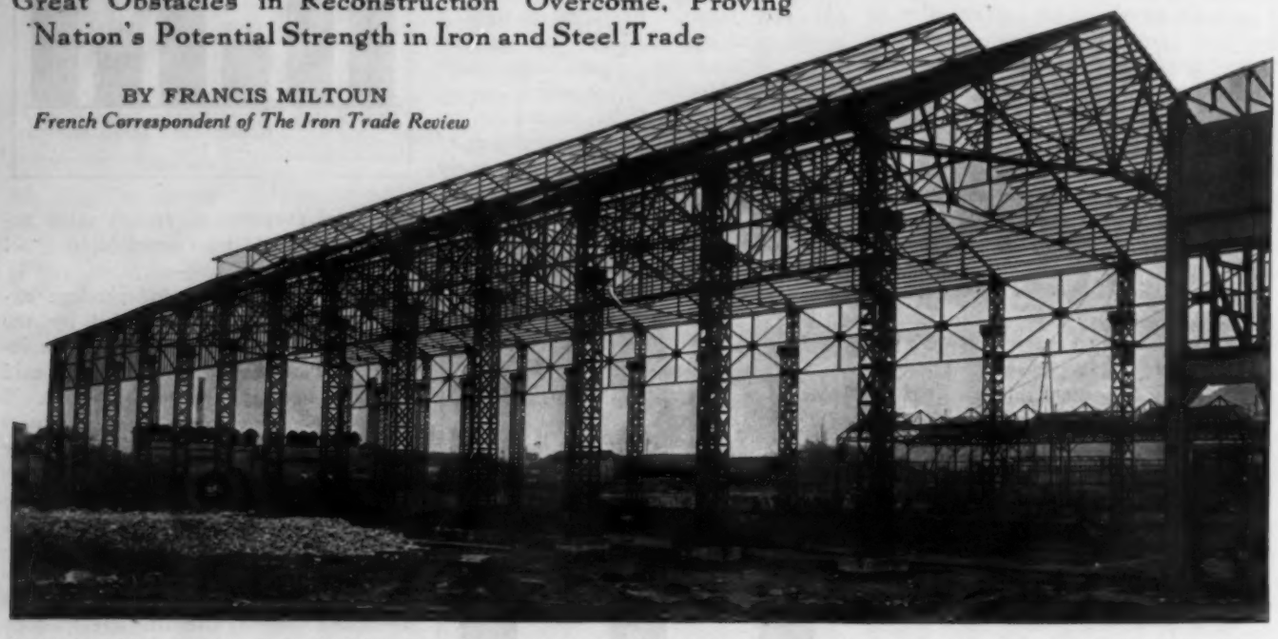
"The export trade is today sound and if we are given a reasonable time for the renewal of our bills everything would be smooth. But we might as well be frank about the situation and realize that organizations which have been built up for 50 years can see no light ahead. Foreign agents are being withdrawn from their fields as there is no business to warrant keeping them there. And all we get from the bankers is sympathetic indifference."

If the American exporter is to develop the opportunities for foreign trade before this country manifestly he should be placed in a position where he can count on the same wholehearted and far-reaching support on the part of the American banks as the British exporter enjoys on the part of his banks. Without such support the iron and steel industry generally will not reap that potential demand abroad which lies before it. Profitable business for 1921 is available but it is not to be expected that the independent export house can get it without the proper co-operation on the part of American bankers and mills.

Operation of Lorraine Plants, France's Step to Leadership

Great Obstacles in Reconstruction Overcome, Proving Nation's Potential Strength in Iron and Steel Trade

BY FRANCIS MILTOUN
French Correspondent of The Iron Trade Review



Construction work in Lorraine. A foundry building as it appeared in August, three months after construction was started. Note blast furnaces in the distance

AFTER a close study of the metallurgical situation of eastern France as it has developed as a result of the war, and an intimate observation of recent achievements there can be no other conclusion than that France is destined to occupy a predominant place in the European iron and steel industry.

Geographically, eastern France divides itself into three distinct regions with respect to its mineralogical and metallurgical resources: Nancy; the Grande Couronne and Briey, and Longwy. Mineral resources are centered chiefly in the Briey and Longwy basins, and production is distributed in a comparatively narrow area running approximately 100 miles in a northwesterly and southeasterly direction, bordering on the frontiers between France and Germany as they existed before the war.

These locations were tactically and economically disastrous for France at that time for the fact that quite three-fourths of its entire metallurgical industry was directly open to attack and destruction by the enemy on the East. For five years not a mine of the celebrated Briey basin gave up a ton of ore, not a blast furnace or rolling mill from Pont-à-Mousson to Longwy produced a kilo of iron or a meter of rails for French account. On the other hand, Germany, under the shelter of the great guns of the encircling forts of Metz, intensively worked the joint deposits of French and German Briey, and was able for the most part to keep in operation the highly organized and efficiently equipped iron and steel plants of Thionville and the contiguous districts east and west of the old frontier which divided the Briey basin.

This remained the state of affairs until the American army advancing north through the Saint Mihiel salient and from Pont-à-Mousson to Pagny-sur-Moselle, where the Americans fired the first long-range shots into Metz, and cut the German rail communications between Longwy and Sedan.

Damage Placed at $82,080,000

It is practically within the confines of the district outlined above that 24 self-contained steel plants, working from the ore to the finished product, have just been able to establish their claim of war damages to the value of 170,000,000 gold marks (normally $40,800,000). In addition there are 205 smaller establishments, second fusion and fabricating plants, claiming 71,000,000 marks ($17,040,000) and 106 machine shops with claims of 21,000,000 marks ($5,040,000); and other establishments working iron and steel in one form or another whose claims bring the total up to 342,000,000 gold marks ($82,080,000). This is the bill for damages to the iron and steel industry alone. The question is, can Germany be made to pay it?

The sum mentioned applies only in part on the valuation of 572,000,000 marks ($137,280,000), the recuperation of nondamaged elements accounting for the difference. The magnitude of the figures shows plainly the supreme importance of the localized industry of what was before the war frontier France but which now has a protective strip of territory to the east some 150 miles wide in parts.

Long before the world war broke, a *Memoire Confidentiele* is known to have been submitted to the German emperor by German metallurgists arguing that for Germany to become mistress of the iron and steel markets of the world the annexation of the basins of Briey and Longwy was necessary.

Immediately after the signing of the treaty of Frankfort, resulting from the war of 1871, Germany began to impose her hegemony of iron and steel on a complacent world. The capping of the climax came in 1913, when Germany was paying 227,000,000 gold marks ($54,480,000) for iron ore from abroad, double the cost of

its native ores which were used by the country's blast furnaces in the Ruhr and elsewhere within the confederation. From the time that the first of the iron ore outposts, the fortress of Longwy, fell before the army of the crown prince the line of attack was apparent to all. The war could have been stopped by the cession of Longwy and Briey to Germany.

Coal the Key to the Situation

Today France, by the reacquisition of that portion of the Briey basin, of Thionville and the contiguous German Lorraine district, becomes the greatest iron and steel productive center of Europe, lacking only sufficient coal, though able to draw on the supplies of the Saar, Belgium and Westphalia.

The annual output of coal in both Lorraine and Alsace did not exceed 3,500,000 tons, valued at 39,000,000 marks ($9,360,000) in 1913, being short of requirements some 15,000,000 tons.

The relative status of the three distinctly defined districts with respect to iron ore production in 1913 was as follows: Nancy, 1,961,921 metric tons; Longwy, 2,904,684 metric tons and Briey, 15,103,849 metric tons.

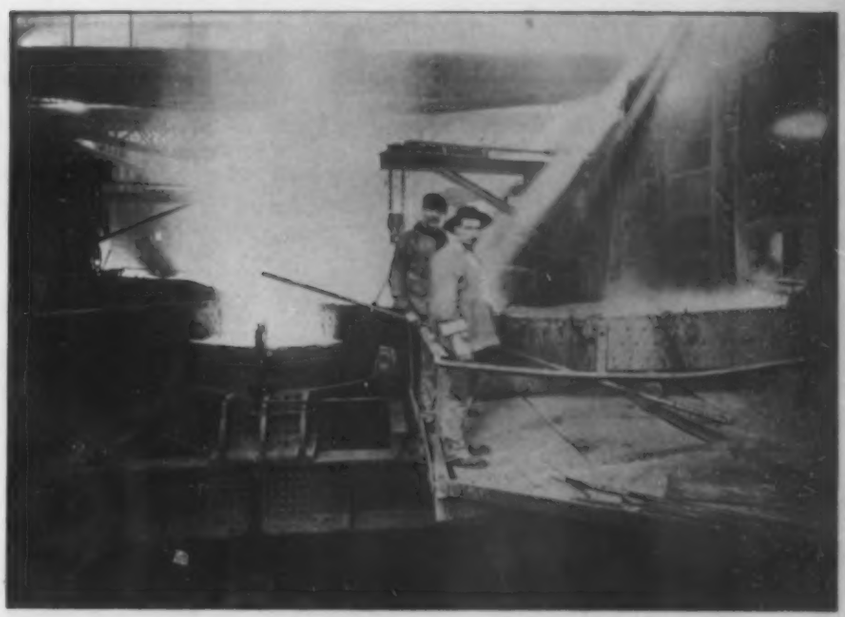
The entire ore production of French and German Lorraine, in metric tons, in 1913 and the countries to which it was shipped was as follows:

Meurthe et Moselle to France	10,016,000
Other districts to France	1,868,000
All districts to Germany	18,937,000
All districts to Belgium	4,934,000
All districts to Luxemburg	3,701,000
All districts to England	69,000
All districts other countries	7,000

The value of the 20,083,288 tons of iron ore produced in 1913 in that part of Lorraine now become French was 53,000,000 gold marks ($12,720,000).

These figures indicate the amount and value of the ore which may be produced in the eastern Briey and contiguous districts, either for the supply of French industry or for use as a medium of exchange with Luxemburg, Belgium and Germany. Due to the reabsorption of German Lorraine by France the latter thus becomes absolutely self-sustaining in so far as minette iron ore is concerned. Minette ore, though containing but 34 to 40 per cent iron, can be mined at low cost. In 1913 the cost was 4.64 francs a ton.

A large proportion of the newly acquired ore deposits will be required on the spot as a result of the acquisition of the former German Lorraine blast furnaces in neighboring territory. Lorraine and Alsace have brought to France 67 blast furnaces, 26 converters and 12 open-hearth furnaces. These will require a large



RECONSTRUCTED 12-TON OPEN-HEARTH FURNACE, THE FIRST TO BE OPERATED SINCE THE WAR IN A LORRAINE STEEL PLANT

proportion of the 18,937,000 tons of ore which formerly was shipped from the region to Germany, probably 5,000,000 tons, and possibly a maximum of 8,000,000 tons. The localized French industry will thus prove to be a consumer of about 20,000,000 tons of ore, all of it to be supplied from the eastern French deposits. Before the war the entire ore production of France, not all of which was consumed within the country, was but 21,918,009 tons, of which the high phosphorus minette ores of Lorraine formed more than 50 per cent, the bulk of the remainder coming from the Longwy and the Nancy districts.

It is estimated that the reannexed district of Lorraine contains 1,500,000,000 tons of iron ore. French Lorraine and German Lorraine together produced 39,137,000 tons of ore in 1913. The amount of ore consumed, in metric tons, by blast furnaces in France in 1913, and the districts from which the ore came follows:

French origin (chiefly from Longwy and Briey)	11,852,000
Algerian origin	53,000
German and Luxemburg origin (Continuation of French basins)	807,000
Spain	458,000
Other countries	92,000
Total	13,262,000

This total consumption, as compared with the need of the now unified Lorraine district, shows a difference of 7,000,000 tons, a fact which emphasizes strongly the preponderant position of the iron and steel industry of Lorraine, upon which the general prosperity of the country depends.

The total annual normal ore production of Lorraine now is 39,137,000 metric tons.

France produced but 5,207,000 tons of pig iron per annum before the war, while that portion of Alsace-Lorraine then under German control produced 3,869,866 tons, of which France imported 475,000 tons. Using these figures as a basis, French production should have increased today to 9,000,000 tons, which it has not, due to hampering economic and political conditions resulting from the aftermath of war.

In 1913 Alsace-Lorraine produced 2,286,534 tons of steel of which 1,253,790 tons were represented in rolled products. Large quantities of these latter products were imported by France. The entire steel production of France during the same year was 4,686,866 tons, little more than double that of German Lorraine. The economic value of the ore and production facilities acquired by France thus, is shown to be enormous. By reannexation, French iron ore production has been increased 21,136,000 metric tons or 99.6 per cent; French pig iron production has been increased 3,569,866 tons, or 68 per cent; French steel production has been increased 2,286,534 tons, or 49 per cent.

In 1913 France purchased in Alsace-Lorraine the tonnage of iron and steel shown in the following table. The figures are significant as it means much to France merely to keep this business at home in the future.

Pig iron	475,000
Iron castings	264,000
Steel rails	237,420
Shapes and profiles	268,035
Merchant iron and steel	552,900
Sheets and strips	96,000
Steel castings	5,750
Tin plate	6,000
Iron and steel wire	121,820

With the exception of tin plate, these importations exceeded those

A TYPICAL BLAST FURNACE IN BRIEY. THE DEBRIS HAS BEEN CLEANED UP, AND REPAIRS MADE, ALTHOUGH THIS, IN COMMON WITH OTHER FURNACES, STILL IS HANDICAPPED BY LACK OF COAL AND COKE

from any other country. All this producing region again is French.

In prewar times eastern France, including the Nancy, Briey and Longwy districts, produced 67 per cent of the national output of steel ingots by the Thomas converter process, and 19 per cent by the open-hearth process.

Attention Focused on Lorraine

Today, with the added resources of reannexed Lorraine, the attention of the iron and steel industry in this richly endowed region becomes more and more firmly focused on the one objective of future development.

With its equipment, natural resources and manufacturing possibilities, Lorraine may be expected within the next few months to arrive at highly intensive production, which will at least bear some comparison with that which was achieved by German and French ironmasters in their respective territories before the war. The first six months' production figures of 1919, the last available, indicate that Lorraine produced 44.6 per cent of the total output of pig iron in France; 32.1 per cent of semifinished steel, and 28.4 per cent of finished steel. The showing is notable, but is susceptible of a great increase both as to volume and percentage of output as compared with all of France.

It is in Lorraine, too, that the French look for the greatest development in production methods. As this territory is situated much nearer the coal fields, transportation of fuel and attendant costs are in its favor, as also, is its position with regard to ore.

In the northern and eastern districts of France there are 235 large iron and steel producing or finishing plants now under reconstruction by their owners and the French war damages commission. Besides, there are 110 machine shops, 500 smaller establishments of the metal trades, 17 locomotive and railway rolling stock plants, nine automobile plants and one firearms factory. All these were idle at the time of the armistice, and today not even a quarter of them, large or small, is operating on a commercially profitable basis. Not a single one is working on a pre-war schedule of output.

Reconstruction is necessary for the restoration of prosperity, for financially, economically, and industrially, the entire district of eastern France was prostrated from the moment the German armies established themselves at Briey and began the exploitation of this rich field for the account of the fatherland. The method was but a repetition of that which was employed in Alsace and Lorraine ever since these territories were in German possession. The government there had sought by all possible means the elimination of French directors and French capital from the business enterprises of the Reichsland.

Aiding the movement for reconstruction, now at its height, two elements having special reference to the iron and steel industrial situation have been brought into being. They are the French war damages commission, of the Nancy district, and the liquidation section for the German owned metallurgical industries of Lorraine, sitting permanently at Metz. There also was formed recently the comité des Forges et des Mines de Fer de l'Est de la France, with its registered office at Nancy. This is a committee developed from a former organization, the efforts of which were confined to the department of Meurthe et Moselle. The organization is under the presidency of Monsieur Dreux, the vice president of the Acièries de Longwy, and among the vice presidents and administrators is Monsieur Laurent, director general of the Forges et Acièries de la Marine. Actually, he is the French ambassador at Berlin. This indicates a significant combination of business and politics of a nature which Europe usually contemptuously refers to as "dollar diplomacy," but to which Europe has had to come. Monsieur Aubrun, chief of the department of mines of Schneider et Cie, another significant participation, and Monsieur F. de Wendel, of Joeuf and others, also are vice presidents. The committee has for its object the study and defense of professional and economic interests of its members through legislation, so far as it may have a bearing on iron, steel and mining developments in eastern France. This is quite a formidable program.

Working in a similar manner on behalf of Lorraine metallurgical interests in particular, is the Institut Metallurgique et Minière de Nancy, an educational organization subventioned by various iron and steel enterprises of the region.

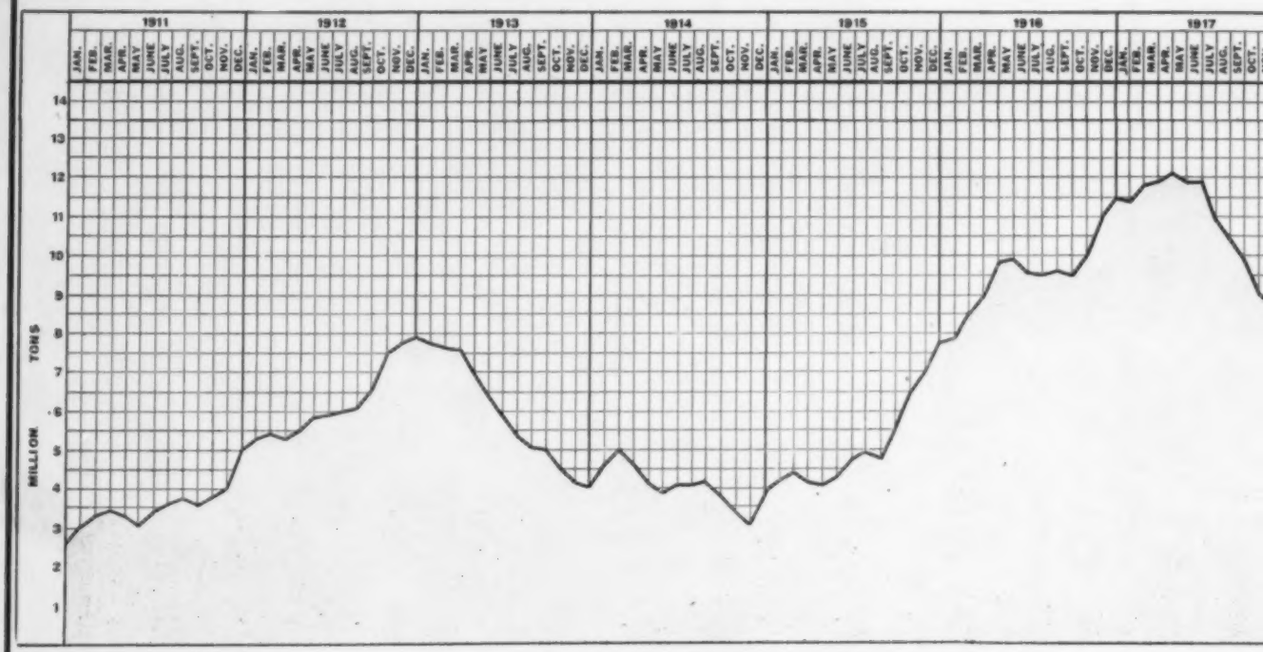
From such elements as here outlined are to be developed a distinctly French iron and steel prosperity such as the country never has known, and only made possible by the return to France of Alsace and Lorraine by the terms of the Versailles treaty.

District Is Naturally Endowed

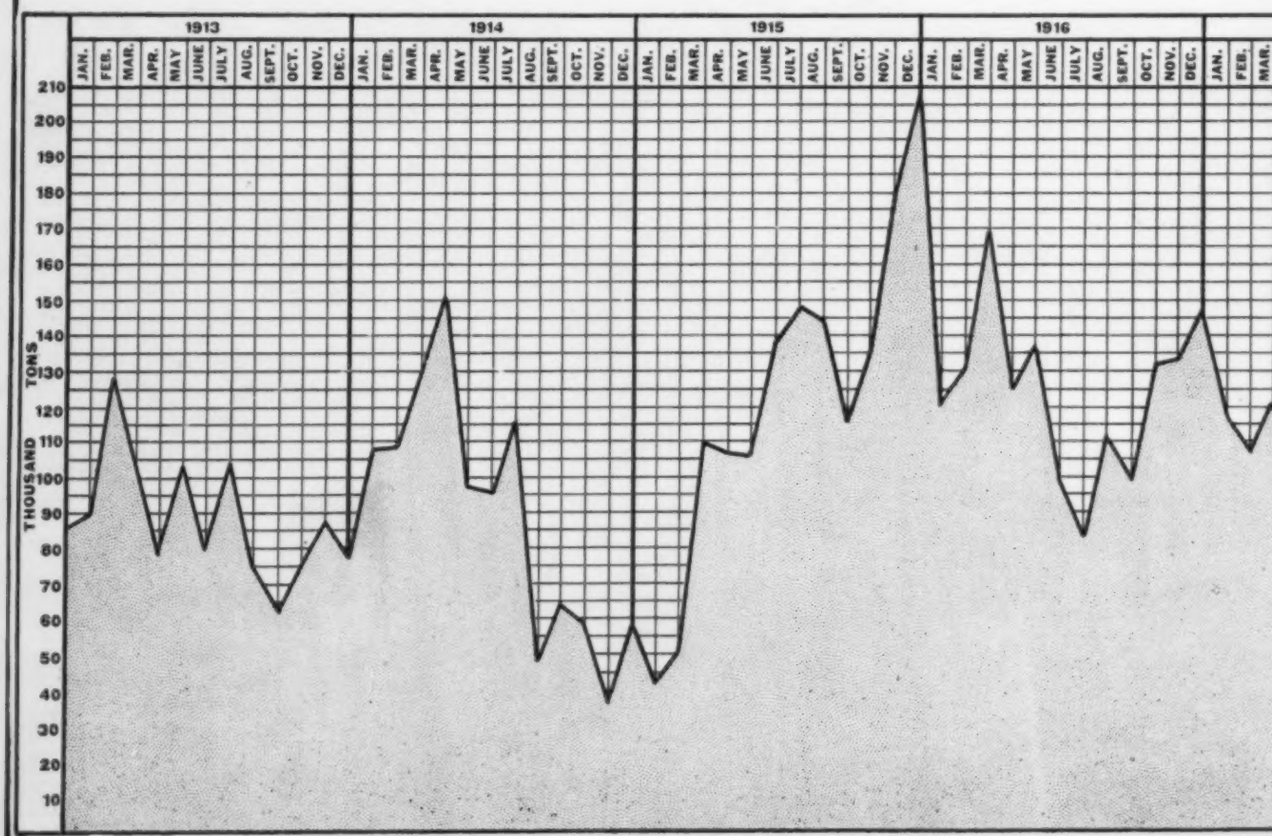
The most important iron and steel production center of France, the Nancy, Briey and Longwy basins, is about as far distant from Paris as Cleveland to Pittsburgh. Here is centered 80 per cent of the iron ore resources and the majority of the plants of the French metallurgical industry. With its natural resources, ample rail and inland waterway communications, the district has been endowed by man and nature more favorably than any other of continental Europe. The Chemin de Fer de l'Est, though having done heroic work during the war, as a result of which its roadbed, bridges, tunnels, culverts, rolling stock and power houses were greatly damaged, has made a remarkable recovery. That section of some 40 miles of railroad running between

Supplement to the Jan. 6, 1921 issue of **THE IRON TRADE REVIEW**

Charts showing monthly structural av



MONTHLY UNFILLED TONNAGE OF UNITED STATES STEEL CORP. 1911-192



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THE IRON TRADE REVIEW

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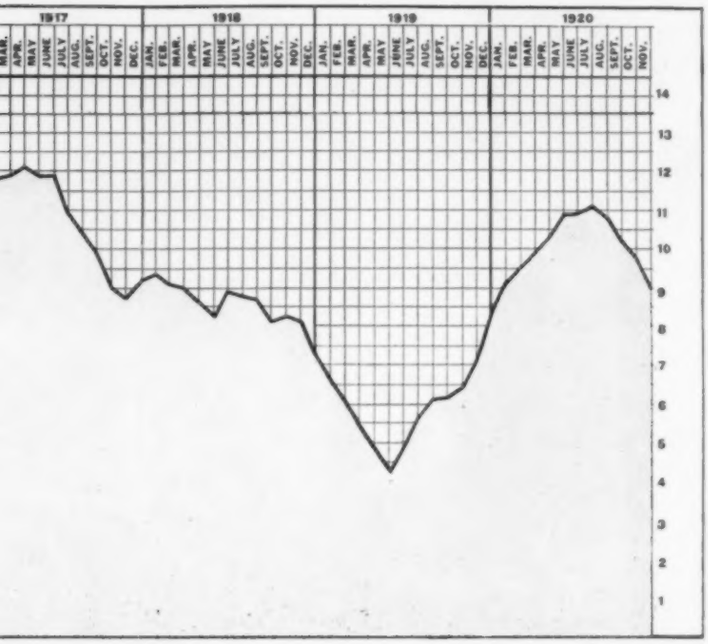

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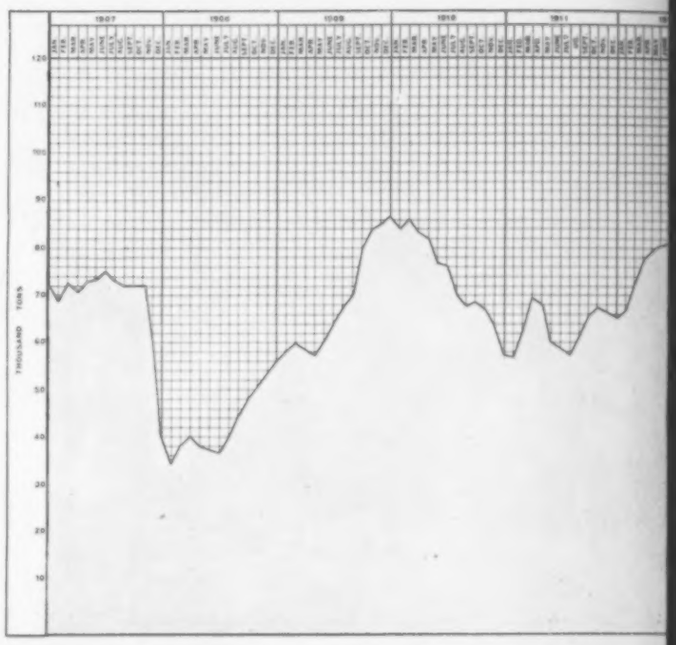

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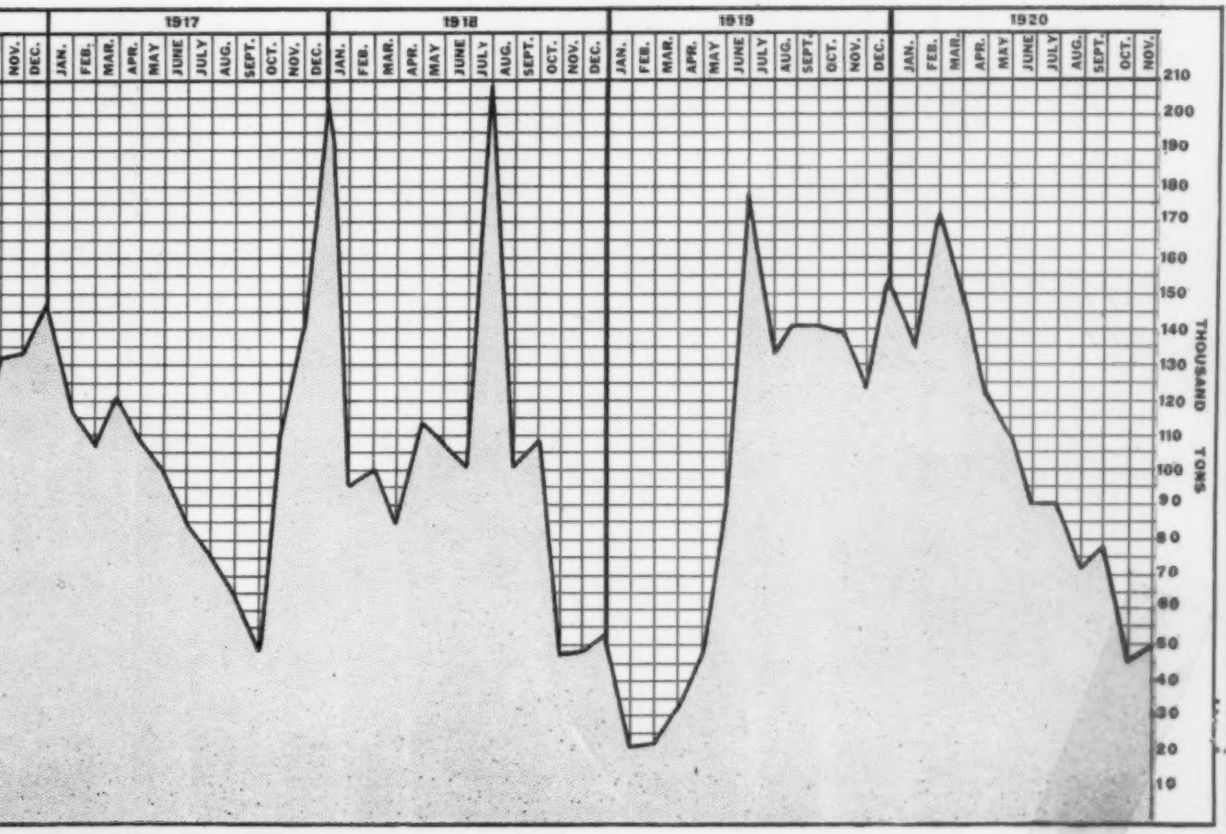

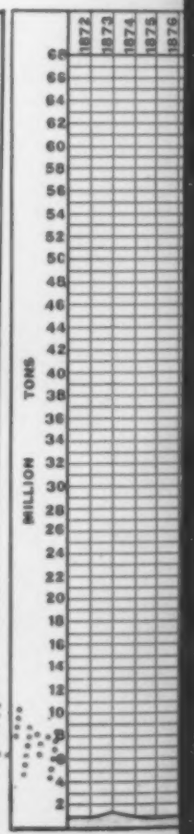

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THE IRON TRADE REVIEW

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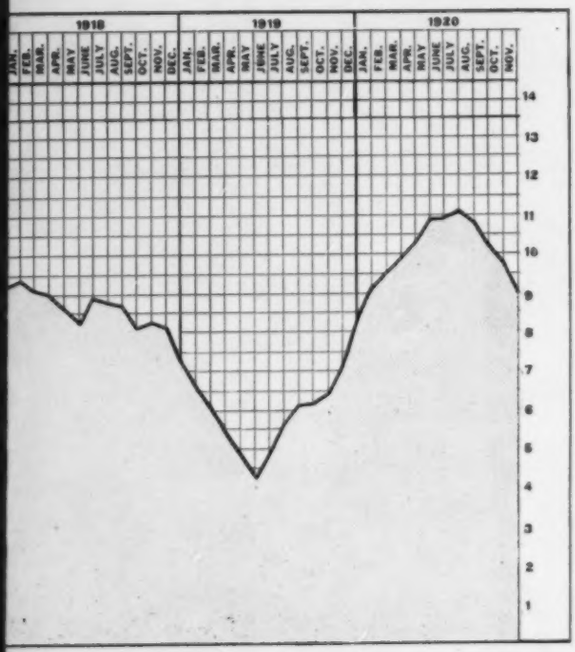

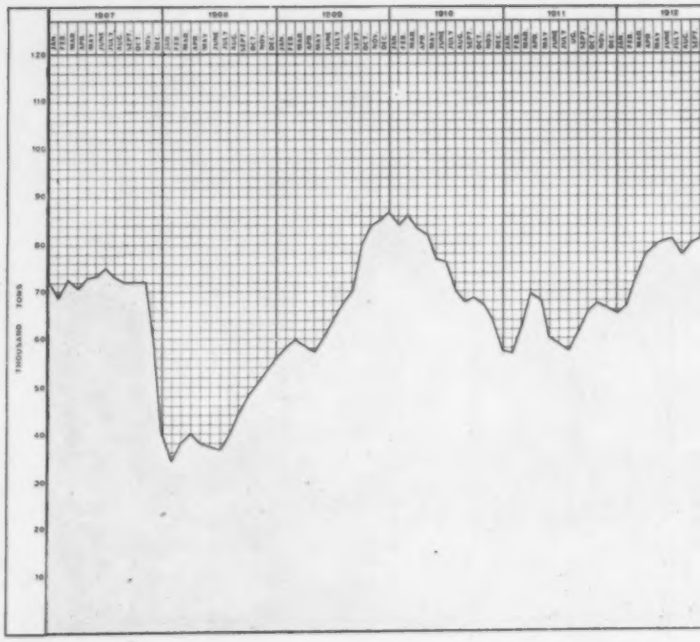

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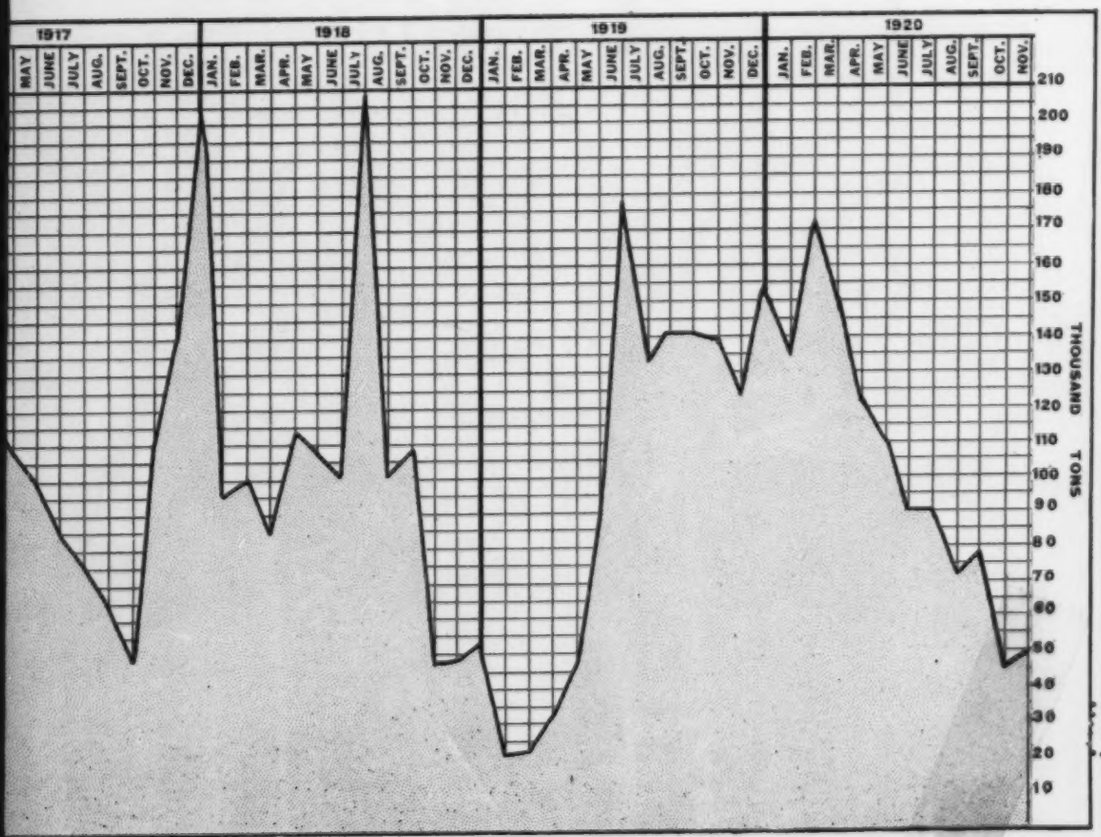
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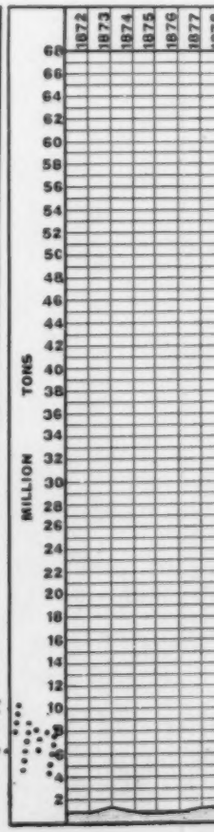
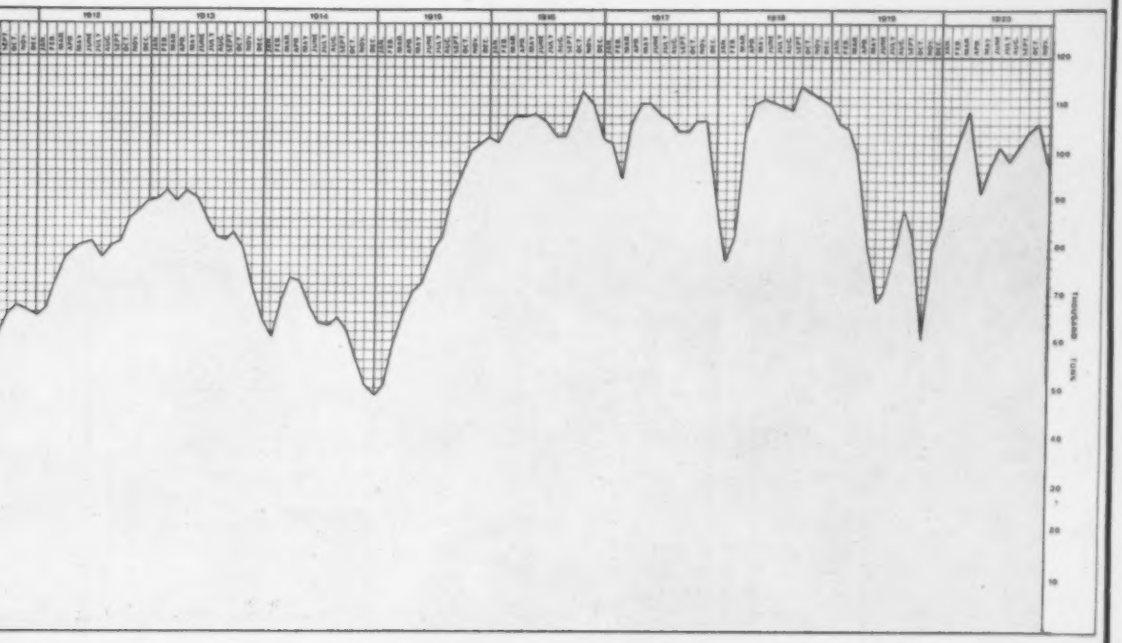
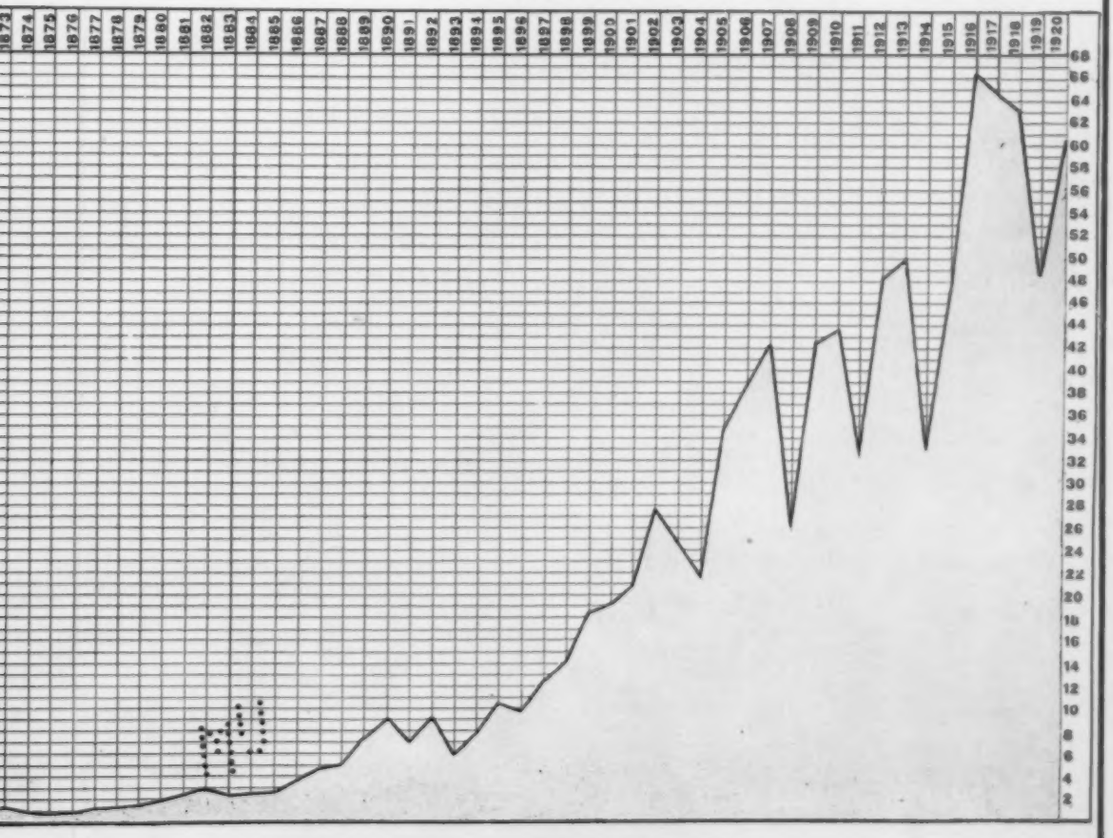


TED STATES BY MONTHS 1913-1920

of Lake Superior iron ore



VERAGE PRODUCTION OF COKE AND ANTHRACITE PIG IRON 1907-1920



SEASON'S SHIPMENTS LAKE SUPERIOR IRON ORE 1872-1920

Nancy and Metz, the twin capitals of Lorraine, and flanked on either side for nearly its entire length with blast furnaces, foundries and steel mills, is being four-tracked.

This may be taken as an indication of the intensive effort being made by the metallurgical industries of the 100-mile strip of "iron country" of the old frontier. Such effort is not observable anywhere else in France.

In this district 872 separate establishments, working iron and steel in one form or another, have been scheduled for participation in the industrial war damages indemnity. On the basis of present-day costs, we find that their total claims should amount to something over 7,000,000,000 francs (normally $1,400,000,000) of which the departments of the Vosges, the Meuse, Meurthe et Moselle and the Ardennes account for 1,000,000,000 francs ($200,000,000). It is proposed, however, to settle them for a quarter of this sum, and this only if cash holds out and Germany can be made to pay sufficient to more than care for the pension budget, which must be provided for first. It is probable, then, that reconstruction and revival will be largely the result of private initiative; certainly it will not be accomplished by German capital as was first commonly thought likely.

On the Eastern railway, long before Nancy is reached one sees long trains of cars interspersed here and there with 5 and 10-ton loads of iron and steel scrap. At Bar-le-Duc, an iron and steel industry which for five years continually turned out cast steel shells under incessant bombardment, one notes the first signs of the intensive activities in prowess, on the borderland of the iron and steel country.

Greatest Progress in Former War Zone

APPROACHING Nancy, Frouard, with its long stocks of cast iron pipe, a specialty of the Nancy district, Pompey, Champigneulles and Maxeville are sending forth the smoke of their furnaces. Railway sidings are blocked in and out with long trains of construction materials and machinery or lesser quantities of manufactured iron and steel. Here and there a plant has remained intact but bombardment at close range either resulted mostly in semidemolishment or caused the owners to dismantle and remove parts to places of safety in the interior of France.

This has resulted in some instances in a division of interests, a play for future safety. For instance, Aulnoye is developing its Montbard plant in the Cote d'Or and the Pont-à-Mousson auxiliary at Saint Etienne du Rouvray in the Seine valley near Rouen.

Little Optimism on Reparation

The general impression on first approach to the region is an intense productive activity. Recovery from the effects of war in this strip, bordering upon the old frontier, scarce 20 miles in width between Nancy and Metz, is being greatly aided by the extensive means of communication. The chief of the war damages commission at Nancy advanced his opinion that all the damages in this district will be made good within five years. This sort of optimism is not found elsewhere in France, least of all in the Nord and Pas-de-Calais departments.

As the old frontier is approached, coal and coke trains from Germany are to be seen on all sidings. These are carrying out the terms of the Spa agreement and are delivering to the allies coal and coke from Westphalia. These Ruhr coal trains in many cases are made up of the American cars left behind by the American expedition. They carry 40 tons as against the 10, 15 and 20 tons of the French and German railway rolling stock. Many of the trains also

MODERN LIME KILNS UNDER CONSTRUCTION IN LORRAINE

are drawn by American locomotives.

The Société Industrielle de l'Est at Nancy the newly founded Comité des Forges et des Mines de l'Est de la France, the Institut Metallurgique et Minière, and the following two important financial institutions specializing in iron and steel operations, the Société Nancéen and the Banque Renauld, tend to make the old ducal capital of Lorraine the grand general headquarters of the metallurgical industry of eastern France. Incidentally, the United States recently established a consulate here.

Visits Pont-à-Mousson

The writer received warm welcome at the Hauts Fourneaux de Pont-à-Mousson, midway between Nancy and Metz, and for five years directly on the frontier line of fire, from the director, Monsieur Lucien Mouchette, who was frequently in America on government mission during the war. The plant was practically razed by more than 300 bombardments, 5000 shells actually falling upon it during the war. Today it is in production again, and three of its five blast furnaces are active. The fires drawn on Aug. 2, 1914 were first relighted by President Poincare on Nov. 23, 1919, practically a year after the armistice.

The Hauts Fourneaux et Fonderies de Pont-à-Mousson is the largest producer of cast iron pipe in Europe. It produced more than 10 kilometers of pipe of all dimensions (about 32,800 feet) daily before the war. Sixty per cent of its product was exported.

It has under construction what is designed to be the largest foundry under roof in all France. The company produces its own iron and coal from mines in which it has interests, the latter in France and Belgium, and before the war even in Germany. Among its rolling stock the company owns 10 hopper cars just received from the Pressed Steel Car Co., Pittsburgh.

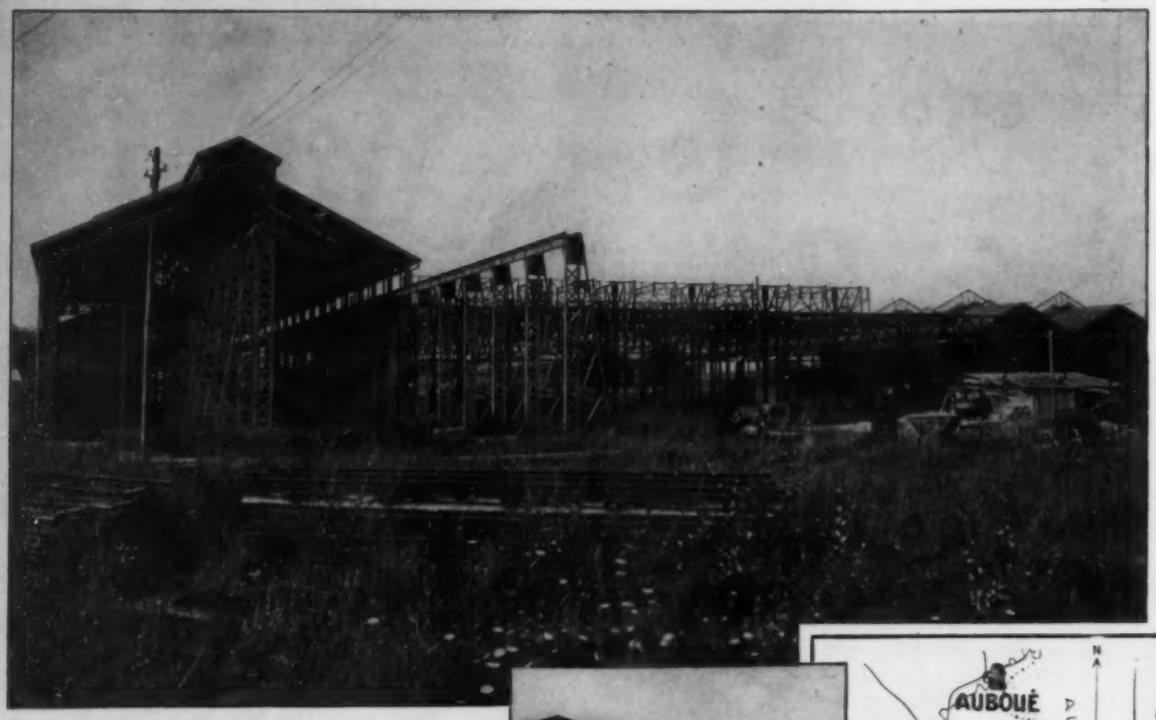
Progress of Reconstruction Work

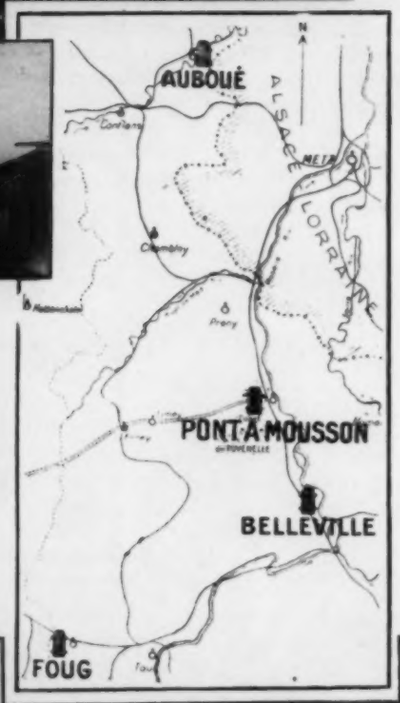
The various steps in the reconstruction of this plant may be set forth as follows:

Dec. 1918	Commencement of reconstruction work.
April 1919	First flat casting made.
Aug. 1919	First perpendicular casting made.
Nov. 1919	President Poincare lighted No. 4 furnace.
Jan. 1920	No. 5 blast furnace lighted.
June 1920	No. 3 blast furnace lighted.
June 1920	Electric central station in operation.

The Societe de Pont-à-Mousson was saved in an economic sense by the operation throughout the war of its allied plants: At Foug., 31 cupolas; at Aboué, mines and three blast furnaces; at Saint Etienne de Rouvray, 17 cupolas; at Sens, a bronze foundry; at Belleville, a machine shop; at Toulouse, 3 cupolas; at Yainville, a tar distilling plant.

Four blast furnaces now are in operation. At the plant was a shambles at the time of the German retreat from the heights back of the town, when the American general staff ordered the complete evacuation of the town, but it was making castings within six months of that date. Among the collection of specimens of





Hauts Fourneaux et Foundries de Pont-a-Mousson, largest producer of cast iron pipe in Europe before the war, now has under construction the largest foundry in France. The above shows a portion of the foundry building three months after the beginning of construction. The map shows the location of Pont-a-Mousson with respect to Alsace-Lorraine. The Societe de Pont-a-Mousson which controls this plant, also has ore mines at Auboue and 31 cupolas at Foug, shown on the map. Ore is hauled from Auboue in American-made cars, one of which is shown in the illustration. Hot metal is brought from the furnaces a quarter mile away. Hauts Fourneaux was the first French plant to export products after the war. Below is shown the famous bridge at Pont-a-Mousson over which American troops marched into German Lorraine.

pipe casting at Pont-a-Mousson is a length of "American cast pipe" made in the Allied plant at Foug under American direction.

A force of 600 is engaged in rebuilding work and 1000 men today are turning out 25 per cent of normal production. In addition to pipe the plant produces cement pipe, coke and bricks of slag and broken stone for road making. In producing and handling the latter a crusher and locomotive crane taken over from the American expeditionary force are used. A battery of coke ovens is in condition for operation and has been waiting an adequate supply of coking coal.

Before the war, Pont-a-Mousson produced 10,000 tons of cast iron products per month; today's production is 2500 tons. Work on the flat castings department is progressing rapidly and the large new foundry is nearly completed. Here will be cast the hot metal, direct from the furnaces a quarter of a mile away, into pipe of all diameters up to 1.50 meters (approximately 58 inches), this being the diameter made for the Paris waterworks since as far back as 1878.

The Pont-a-Mousson plant is the first French establishment to export the product since the war ended. "Not for profit," as Monsieur Camille Cavallier, the *administrateur-general,* says, "but to offer a good example to others." "For 18 months," he continued, "we

TWO YEARS AFTER THE WAR—A ROLLING MILL AT BRIEY, WHICH WAS UNDER THE GUNS OF METZ, WITH THE DAMAGE STILL TO BE REPAIRED

have worked under pressure and at a loss, because it was our duty to give work to those who want and need work and to reconquer some portion of the world market for France."

Incidentally, the exportation of cast iron pipe by the company increased 104 per cent in the six years just previous to the war, while the plant's production of pig iron was raised during the same period 87 per cent. Among the innovations at the Pont-à-Mousson plant is an elaborate program of welfare work, social hall and workmen's dwellings and gardens, etc.

A curious graph worked out in the offices of Pont-à-Mousson shows this one striking fact: In 1913 French consumption of iron and steel per capita was 242.4 pounds, while German consumption was 427.5 pounds.

Pont-à-Mousson, the town, was decorated with the croix de guerre. Of 1887 rooftops 1640 were destroyed, and its population fell from 14,000 to 6000 during the war.

The Aboué plant with its ore mines of Aboué, Moineville, and Mairy, covering an area of 6000 acres, and its three blast furnaces was in German possession during the war. It suffered pillage and depredation at German hands upon the advance of the American army in the Saint Mihiel sector, but now is mining ore for the plant at Pont-à-Mousson, and already has one of its three former blast furnaces in operation.

Nomeny, Marbache and the Aciéries de Dieulouard suffered during the invasion, the town of the first named having been burned to the ground and 50 of its inhabitants massacred. The latter, neighboring upon Pont-à-Mousson, suffered almost continuous bombardment, but is now recovering and reconstructing its open-hearth furnaces, the first of which is ready for operation, with the second likely to be ready before the end of the year. Reconstruction of the rolling mill is less advanced.

Mines Penetrated Before War

Previous to the declaration of war German interests had penetrated into the iron mines of Briey to the following extent:

Areas in Hectares (A Hectare is 2.71 acres)		Interest
Jarny	812	Hoerde, Phenix, Hospe
Murville	496	Aumetz-Friede
St. Pierremont	917	Gelsenkirchen
Errouville	948	Lux, Bergwerke Saarbrucken
Serrouville	720	Rumelinger und Sankt Ingerberter
Moutiers	696	Deutsche Lux Bergwerkes
Valleroy	886	Roechling-Saarbrucken
Bellevue	589	Lux und Saarbrucken
Batilly	688	Thyssen
Jouaville	1031	Thyssen
Anderny-Chevillon	.....	Thyssen
Conflans	820	Dillinger
La Mourriere	.....	Sambre-et-Moselwerke

In all this area, approximately 22,500 acres, of French iron deposits were contributed directly to the prosperity of German metallurgy.

With the treaty of Versailles France found itself possessed of its old frontiers of 1870 and it was stipulated therein that the German-owned mines and steelworks of reannexed Lorraine should pass to French owners. These properties had been under sequestration by the French since the advance of the allied armies following the armistice. All this was accomplished in good order, but ignoring a suggestion which was supposed to have emanated from the Comité des Forges the treatymakers neglected to demand from Germany, as a contingent condition, sufficient Westphalian coal and coke to keep these plants going. The need for this was not long in manifesting itself, and still endures. The reason for these former German metallurgical industries being located as they were, was the facility with which they might be supplied with German coal. Without this the ore itself might as well have been transported to Germany. This is what France does not want to do, despite the fact that she needs more coal and Germany needs more ore. This is the crux of the whole situation and it is a serious economic handicap which the treatymakers ignored completely, though the business man of France saw it clearly.

It is the chief reason why France now has a "political coal problem." The effects are shown by the fact that Germany's metallurgical interests at present are working well above 50 per cent of their normal capacity while those of France scarcely are doing 30 per cent.

When Germany, in 1871, annexed that part of Lorraine extending from the Moselle to the Rhine 38 blast

furnaces of the region were producing less than 250,000 tons of pig iron per annum. Today's exploitations of iron mines total 59. Their output goes to 68 blast furnaces, 27 converters and 10 open-hearth furnaces of the latest and most efficient type. Almost all this development by German ironmasters dates from 1880.

The names, location, equipment, capacity and output in 1913 of these self-contained plants was as follows:

ACIERIES DE WENDEL, HAYANGE
9 blast furnaces, 100 to 200 tons
6 converters, 13 tons
4 open hearths, 30 to 45 tons
519,393 tons of pig iron
398,939 tons of steel products

ACIERIES DE WENDEL, MOYEUVRE
8 blast furnaces, 120 to 190 tons
4 converters, 12 tons
Rolling mills, etc.
328,148 tons of pig iron
261,837 tons of steel products

ACIERIES THYSSEN, HAGONDANGE
6 blast furnaces, 300 tons
5 converters, 30 tons
2 open hearths, 60 to 80 tons
3 electric furnaces, 6, 8 and 10 tons
Rolling mills, etc.
490,383 tons of pig iron
435,000 tons of steel products

ACIERIES DE ROMBAS, ROMBAS
8 blast furnaces, 200 tons

ACIERIES DE ROMBAS, MAIZIERES
4 blast furnaces, 180 to 200 tons
6 converters, 22 tons
4 open hearths, 20 tons
Rolling mills, etc.
Output of both plants
769,000 tons of pig iron
590,000 tons of steel products

ACIERIES DE KNUTANGE, KNUTANGE
10 blast furnaces, 200 tons
6 converters, 30 tons
620,000 tons of pig iron
468, 00 tons of steel products

The de Wendel plant was virtually French, as it had been for generations; the others, excepting Knutange, were distinctly German. Knutange had a certain participation of Belgian capital interests therein, though an avowedly German company. Other Lorraine plants of this district specializing in pig iron production were:

HAUTS FOURNEAUX D'UCKANGE
6 blast furnaces of 50 tons, producing 261,000 tons

HAUTS FOURNEAUX DE THIONVILLE
4 blast furnaces of 250 tons, producing 316,000 tons

HAUTS FOURNEAUX D'OTTANGE
3 blast furnaces of 150 tons, producing 260,000 tons

HAUTS FOURNEAUX DE RODANGE
3 blast furnaces of 100 tons, producing 91,000 tons

Only the last mentioned had any capital other than German.

In the transferring of these sequestered German properties, just completed, the preference of acquisition by French interests was given to those French companies which had suffered most as a result of the depredations of war, payments being arranged for by releasing claims which the acquiring company held against the state for damages.

One of the most powerful of these groups is the Societé des Etudes et Enterprises Industrielles d'Alsace-Lorraine, composed of the following companies: Marine et Homècourt, Micheville, Pont-à-Mousson, Acièries de France, Fives-Lille and Alais. They acquired the Rombas plants for 125,000,000 francs (normally $25,000,000).

Knutange was taken over for 107,000,000 francs ($21,400,000) by the Participation Minière et Metallurgique d'Alsace et Lorraine, the principal power therein being the Micheville company. The Thyssen plants were purchased by the Groupment des Consommateurs de Produits Metallurgiques, composed of a number of French automobile manufacturers. Adun-le-Tiche was acquired by the Syndicat de l'Alsace and Ottange went to the Acièries de la Marine.

Work in all these plants has been continued by their new occupants on such terms and conditions as obtained locally, and not without labor, wage and provisioning difficulties which in most respects have not differed greatly from those elsewhere in France. The real difference lies in the fact that German labor largely predominates, and most of those who wished to remain were allowed to do so. Labor was divided into four distinct nationalized classes by the French government when it took over the civil administration of the reannexed provinces, and industry was governed itself more or less by this schedule in recruiting workmen for its plants.

The four classes were composed as follows: (1) Of pure French, Alsacian or Lorraine origin; (2) of mixed French-Alsacian or Lorraine birth; (3) of foreign birth; (4) of pure German origin. The former Hagondange, Thyssen, plant some months after the transfer had its payroll composed thus: 68.5 per cent in class 1; 5.6 per cent in class 2; 14.4 per cent in class 3, and 11.5 per cent in class 4.

With adequate coal and coke supplies coming forward regularly these Lorraine plants are exceptionally favorably situated for production and distribution. Rail facilities west and south are being improved daily, and water communications via Metz and the Moselle to the Rhine-Marne canal and Strasburg, thence to tidewater or to Switzerland, can well carry a greater traffic than they actually do. Eventually a waterway from Thionville to Metz, already begun, will be completed and will improve facilities still further for reaching central and Mediterranean France via the Rhone-Rhine waterway.

Available on the spot are iron ore resources estimated at 150,000,000 metric tons, with a like amount from the contiguous Briey field not 50 miles to the west. Annual ore production of this eastern field supplying the former German plant is, or was in 1913, 21,336,000 tons, of which, in the year, the German plants used 11,117,000 tons. Of this production, while France already had possession of the western Briey field, but a bare 500,000 tons was shipped from the eastern field to native French plants, 3,500,000 tons to Luxemburg and 237,000 tons to Belgium.

The current price for Briey iron ore averaging 36 per cent metallic iron in September, 1920 was 26 francs a ton f. o. b. cars at Conflans-Jarney, The price of Lorraine ore was 18.50 francs to 20.50 francs, f. o. b. Moyeuvre. French Lorraine mining cost for the low grade ores in 1913 was 4.64 francs a ton. The cost today certainly is more than double that, while freight rates have been more than tripled. It is manifest that the most favorably situated European iron and steel plants can not hope ever to equal the former low production costs in semifinished and finished products.

In the Briey basin proper the big metallurgical industries are less advanced toward complete reconstruction than those of either the Longwy or the Nancy districts. The de Wendel plant at Joeuf is pushing forward actively. Three blast furnaces, a converter and a blooming mill have been in intermittent operation and would have been in continuously had coke been regularly available. The Homècourt plant of the Societé de l'Acièrie de la Marine is rearranging its entire installation, which as in the case of Micheville, is retarding the time when its forges and rolling mills will again be in normal operation. The blast furnaces of the Homècourt plant are expected to be ready before the end of the year. The neighboring Aboué plant has one of its blast furnaces in operation, with two others on the eve of being reconditioned.

Virtually reannexed Lorraine has the capacity to use all the pig iron output within its borders but its annual consumption of steel is not more than 275,000 tons, leaving a possible remainder, as based on 1913 output, of nearly 3,000,000 tons, for which an outlet has to be found, either in France or abroad. This presents another economic problem of vast proportions. French steel production in 1913 was 4,686,866 metric tons, including 3,186,650 tons of finished products. To add another 3,000,000 tons to this is to increase output above the French absorption point.

Tools Show Marked Tendencies

Machines of 1920 Reflect Trend Toward Refinement in Design—Location of Motors Receives Consideration—Simplicity New Aim in Drill Press Design—Automatic and Continuous Machines Gain Favor

BY OSCAR E. PERRIGO

IN REVIEWING the engineering situation of the machine tool industry and analyzing its various phases of development during the year 1920, three clearly defined tendencies are noted. Moreover careful study shows that compared with former years, 1920 has been unusually productive of new ideas in machine tool design.

There has been a more pronounced tendency to drive machines by individual electric motors instead of by shafting, belts and countershafts, or even by the system of group driving which was so popular a few years ago. Furthermore a large number of machines are being specially designed to accommodate the individual motor. When it was first proposed to drive machine tools by individual motors there was objection to the plan as it seemed to involve the attachment of brackets, shelves and other similar disfiguring contrivances to the machines as supports for the motors which were frequently placed on top of the machines, much to the detriment of their attractiveness. When the motors were not placed over the machines they frequently were placed at the front, rear or the end of the machine—in each case appearing as an afterthought, rather than a well considered and intergral part of the machine itself.

In the more recent designs of many machines the motor is being given a fair share of the designer's attention and well considered plans for its location are being devised by which its disagreeable obtrusiveness is obviated while its practical usefulness is in no wise impaired. As these studies are pursued along proper engineering lines the electric motor is being more and more considered as a legitimate and integral part of the machine itself. In fact it now is not infrequently placed out of sight entirely, as in the front cabinet of a lathe, where it is well protected from dirt, moisture or accidental injury to any of its parts.

The second prominent feature of modern designing of machine tools is the automatic devices introduced in many machines that were formerly operated entirely by hand. For years we have been accustomed to the automatic screw machine whose work and productive capacity has been duly appreciated; but it has been far outdone by the multiple spindle automatic screw machine, now developed to such a practical and complete degree as to leave little to be desired. The automatic milling machine, in both the horizontal and vertical form, is noteworthy for its large productive capacity and for its remarkable accuracy. The automatic lathe is another product of the ever-active brain of the machine designer, and appears likely to be developed to still further usefulness, as another unit in the long list of automatic machines.

Since there is a much greater demand for accuracy in all classes of manufacturing work, the various designers of grinding machines have found new fields, and here again production has been combined with accuracy, and more recently automatic features have been incorporated.

The third distinctive advance in machine design is the exclusive development of single purpose machines. These have resulted from the desire of machine designers to produce practical tools more worthy of their professional skill. The sec-

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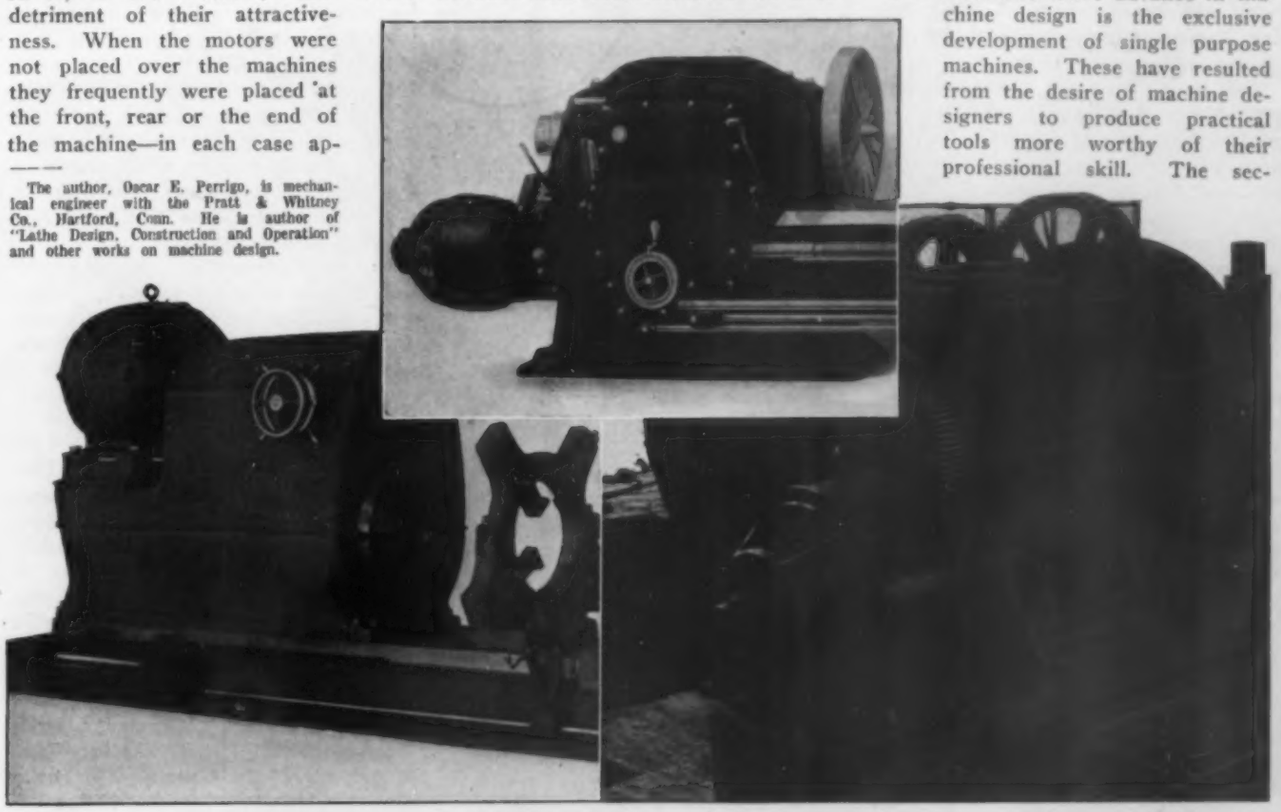


WHERE SHOULD THE MOTOR BE PLACED? THAT DESIGNERS DIFFER ON THIS QUESTION IS INDICATED BY THE ILLUSTRATION

Fig. 1—Motor mounted on the headstock Fig. 2—Here the motor has been bolted to the end of the bed Fig. 3—A special foundation supports the motor for this lathe. The author believes that in small and medium sized lathes the motor should be in a cabinet, where it is protected from dust

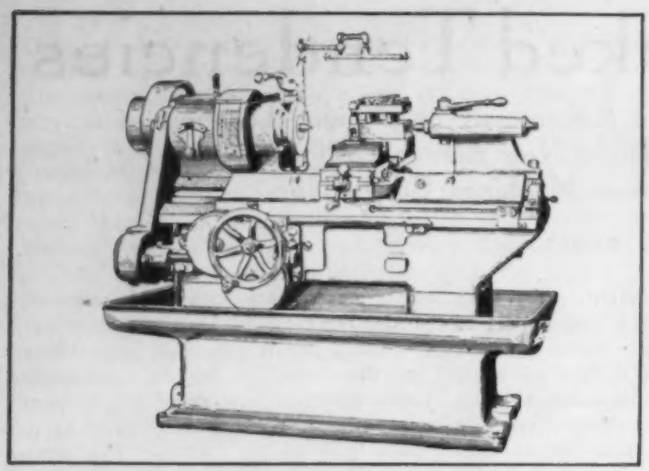


FIG. 4—COMPACT LATHE FOR SMALL WORK
About 75 per cent of lathe work is less than 15 inches long and under 2 inches in diameter—within the capacity of this machine

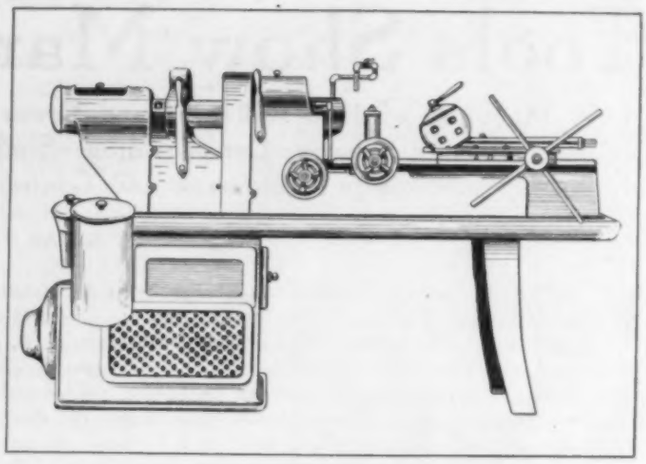


FIG. 5—THE MOTOR IS OUT OF SIGHT
In this recently developed turret lathe the motor is mounted in a specially designed cabinet. A belt connects spindle and motor

ond incentive to the design of automatic machines and attachments has undoubtedly been the high cost of labor. Single purpose machines with automatic features can be operated by men of only average skill, and when these machines are properly placed, one operative may look after several machines, producing a larger output per dollar of labor cost than a highly skilled man on a machine designed for general work. The country demands greater volume of production at less cost per unit, and the natural tendency is in the direction of automatic machines. Undoubtedly much will be accomplished along this line during the coming year by designers of machine tools.

The lathe, being the oldest machine tool and frequently called the "king" of machine tools, merits first place in consideration. Four departures from conventional design have been noted during the past year. The first is the effort that has been made and is still being made to drive lathes by individual motors and to locate these motors in such positions as to render them less objectionable from the standpoint of appearance.

When the first demands for electric drive were made, little thought was given to the location of the motors. Their presence was tolerated by the lathe builders and no great effort was made to mitigate their incongruous appearance. They were set up on brackets, as shown in Fig. 3, mounted on top of the headstock, as indicated in Fig. 1, or bolted to the head end of the lathe, as in Fig. 2. The writer designed a 60-inch lathe in which the motor rested on brackets very close to the floor and directly in front of the headstock, in the endeavor to make it less conspicuous. However, it was an eye-sore. The only proper place for a motor driving a lathe is in the front cabinet, if the lathe has a cabinet, and if it has not, one should be provided except in very large lathes, so that the motor will be out of sight entirely. In the machine ilustrated in Fig. 5 this provision has been made.

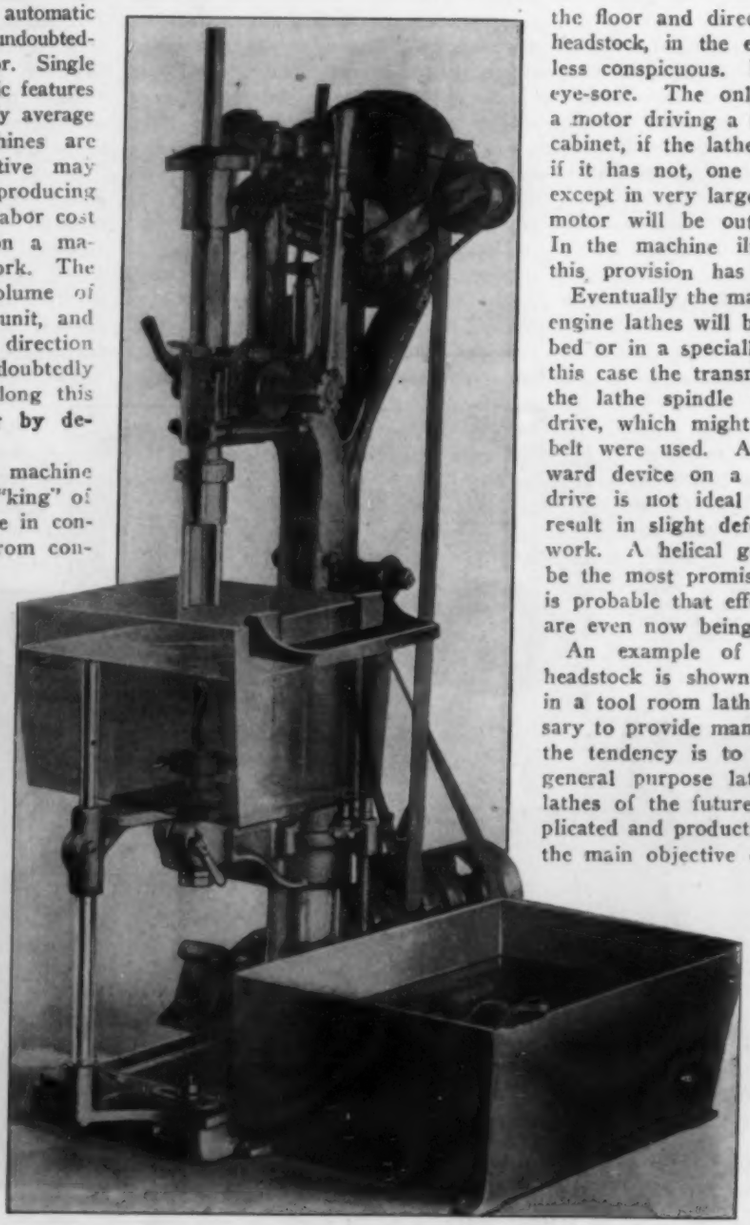


FIG. 6—THE WORK REVOLVES OVER AN INVERTED DRILL

Eventually the majority of motors for engine lathes will be placed within the bed or in a specially built cabinet. In this case the transmission of power to the lathe spindle will be a vertical drive, which might be too short if a belt were used. An idler is an awkward device on a lathe and a chain drive is not ideal as it is liable to result in slight defects in the finished work. A helical gear drive seems to be the most promising solution and it is probable that efforts along this line are even now being made.

An example of the geared lathe headstock is shown in Fig. 7. While in a tool room lathe it may be necessary to provide many speeds and feeds, the tendency is to restrict them in a general purpose lathe. Probably the lathes of the future will be less complicated and productive capacity will be the main objective of designers. This tendency is shown in simpler types of modern lathes.

About 75 or 80 per cent of the machine parts handled on a lathe are less than 15 inches long and under 2 inches in diameter. It is quite evident that a lathe similar to that shown in Fig. 4 is ample

for a large portion of such work. It will turn out as much work as a more complicated lathe, while occupying only half as much floor space. On cuts of 6 inches or over a bright operator, on piece work can easily run four of these lathes. Therefore the short lathe as a single purpose machine is likely to be much in demand in the future.

A further development of the single purpose machine is the automatic lathe, which is suited to a large range of manufacturing work and requires less attendance than the automatic screw machine. A vertical magazine holds the centered work by the ends; the feed is by gravity; the tail stock, tools, etc., are operatd by suitable cams and the work falls out when completed.

In all the progressive lathes of the present time the geared head is rapidly supplanting the belt driven head with its four or five-step cone, and it probably will not be long before the belted cone will be seldom seen on a lathe.

When a lathe is to be driven by a motor the question to be decided is whether it shall have a constant speed or a variable speed motor. It is true that a constant speed motor is sometimes preferred on account of its smaller dimensions, but it entails the use of much gearing to produce the changes of speed required. On the other hand, while the variable speed motor produces a series of fast speeds, a lesser number of reducing gears is required to provide the slower range of speeds. Therefore it is necessary in either case to use gearing to reduce the high motor speeds. The choice lies between a small space and many gears, or more space and fewer gears. Doubtless this question will be satisfactorily solved in the lathe designs of the coming year. Here again the helical gearing may be the solution of the problem which has puzzled engineers.

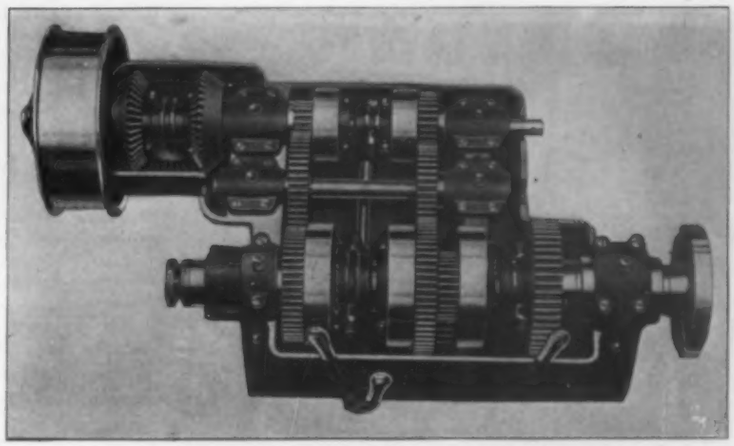
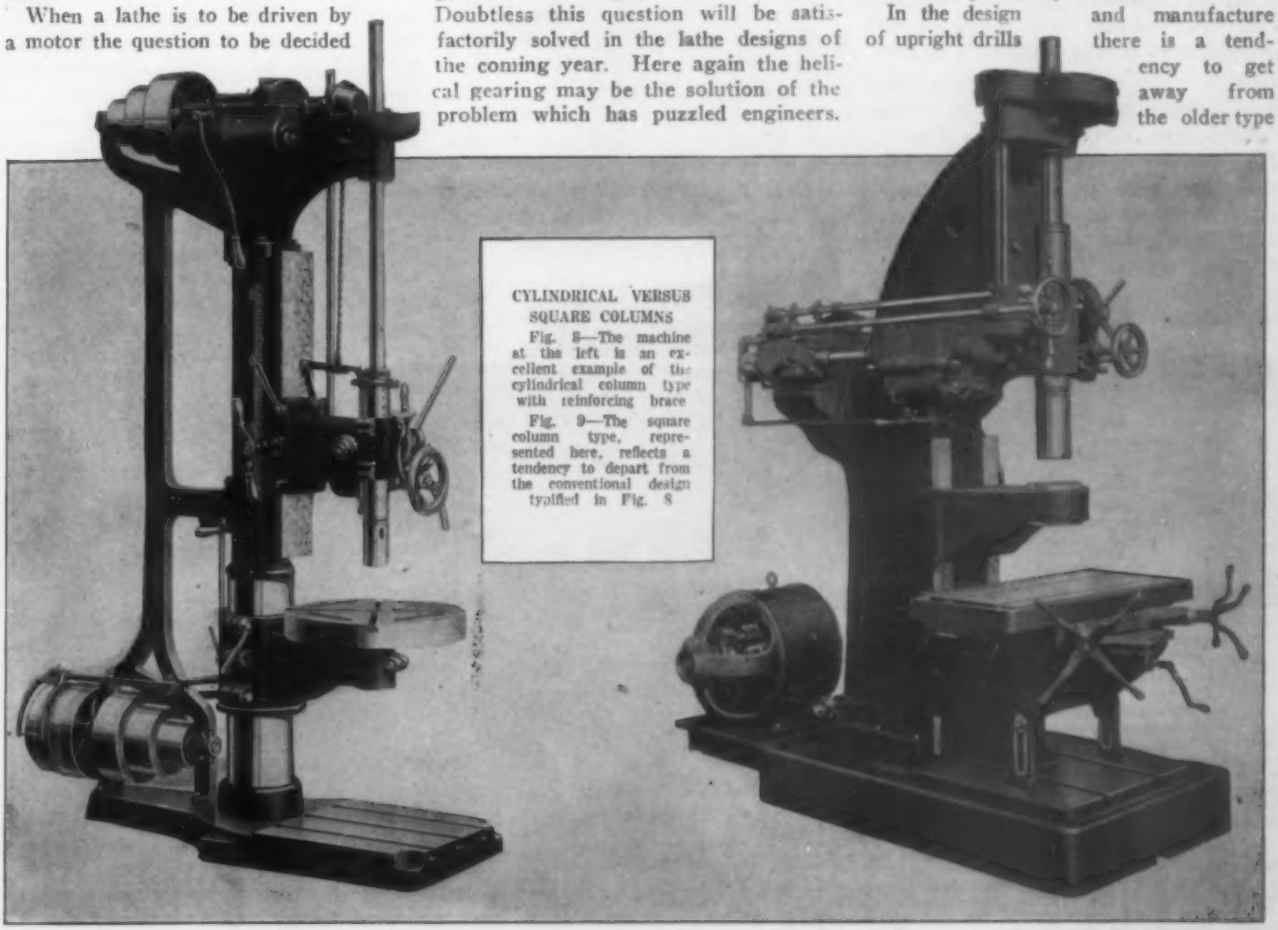


FIG. 7—GEARS AND SHAFTS IN TYPICAL GEARED LATHE HEADSTOCK

In turret lathes the most noticeable departure from the conventional forms to which we have been accustomed is seen in a recently announced "tilted turret" lathe which is shown in Fig. 5. In this lathe a serious attempt has been made to solve some of the problems mentioned above. The effort is in the right direction, although the effect might have been better if a little more attention had been given to proper proportion, and symmetry of outline. Even if machines do their work with a reasonable degree of accuracy and speed, their selling qualities should be duly considered if they are to prove a financial success to the builders.

Magnetic chucks have proved their usefulness, particularly on grinders, but also on lathes, planers and milling machines. However, the recently developed air chuck seems to be better adapted to lathe work, and several excellent examples are now on the market. They meet with much favor on account of the rapidity and ease with which they are operated.

In the design and manufacture of upright drills there is a tendency to get away from the older type



CYLINDRICAL VERSUS SQUARE COLUMNS

Fig. 8—The machine at the left is an excellent example of the cylindrical column type with reinforcing brace

Fig. 9—The square column type, represented here, reflects a tendency to depart from the conventional design typified in Fig. 8

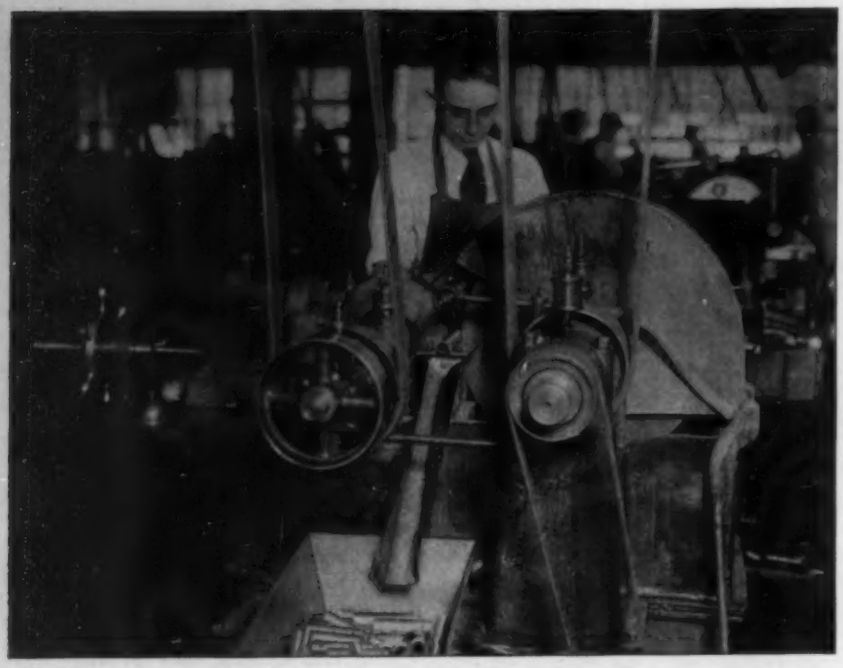


FIG. 10—THE CENTERLESS GRINDER IS ONE OF THE INTERESTING DEVELOPMENTS IN GRINDING MACHINERY—NO CHUCKS OR CENTERS ARE USED

of cylindrical columns with their well-known strengthening back-frames and to provide a square column having a broad face upon which the table-supporting bracket slides, similar to the knee of a milling machine. The result is a very rigid machine, well suited to the heaviest work that is liable to be placed upon it. The cylindrical column type is well shown in Fig. 8, and the square column type is illustrated in Fig. 9. The machine in Fig. 8 illustrates the former tendency to use a multiplicity of gears, shafts, levers and other parts while the drill shown in Fig. 9 is representative of rigid design. The multiplication of parts is omitted, yet the machine is adapted to a variety of work as extensive as before the machine was simplified.

Continuous Drilling Machines

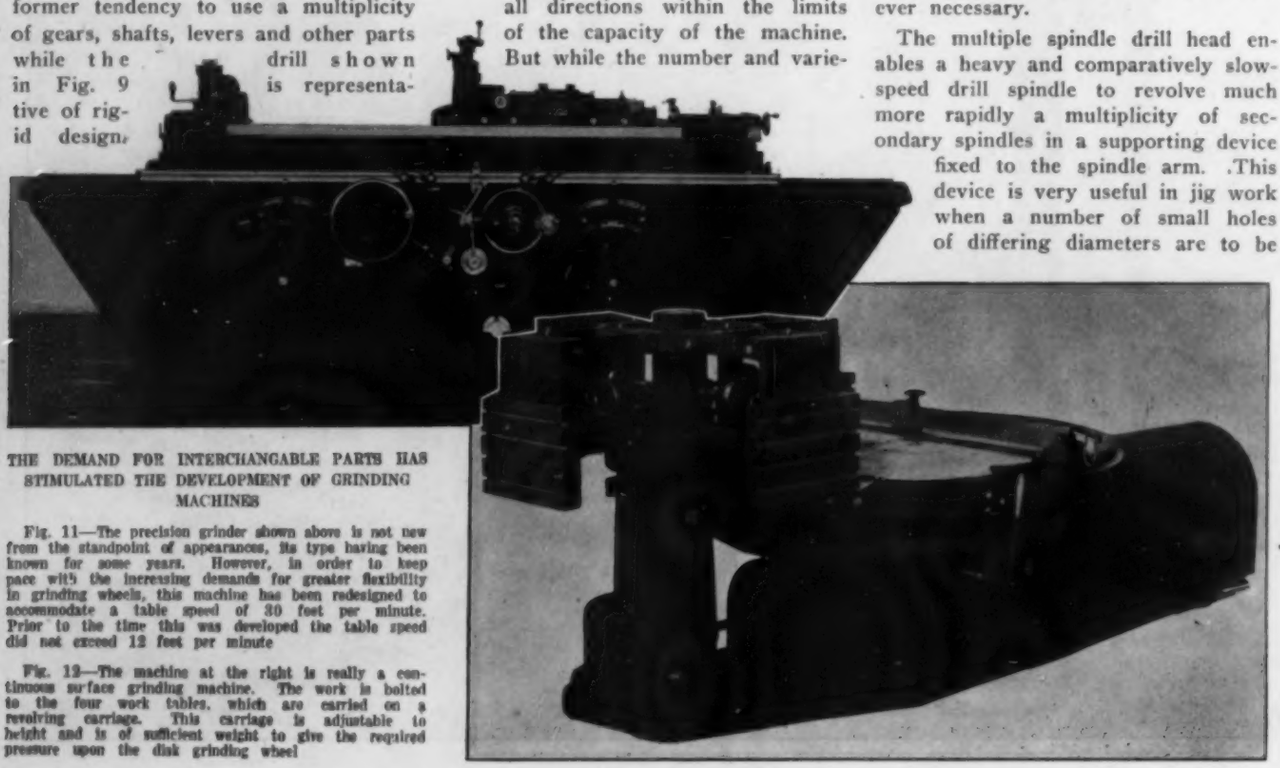
The present tendency toward the use of multiple spindle drills is also quite marked. Some machines of this type provide only for the adjustment of several spindles along a straight line, while others are arranged so as to permit the adjustment of the spindles in all directions within the limits of the capacity of the machine. But while the number and variety of multiple spindle drilling machines have greatly multiplied, the most novel departure from conventional design is in the practically continuous drilling machine. The table is loaded with parts to be machined which pass under successive drills, counterbores, or milling tools, as the rotation of the table carries the parts to their proper stations.

Build Horizontal Type

To such an extent does the multiple spindle idea appeal to the users of drilling machines that a double-headed multiple spindle drill of the horizontal type has been placed on the market. This machine is intended for work requiring holes in two opposite sides that can be fixed to the central table and completely drilled at one setting and in practically half the time required for the best upright multiple spindle drill. As a rapidly operating manufacturing machine it doubtless will prove a success.

A radical departure in drill is that in which the drilling process proper is turned upside down, as shown in Fig. 6. In this machine the usual drill table is removed and the inverted drill is mounted on the table-supporting arm in a tank of water or lubricant. The piece to be drilled is carried in a chuck or other suitable fixture attached to and rotated by the main spindle of the machine. Since the chips fall from the drill as fast as they are made, there is no clogging, and the drill is automatically lubricated at all times. Provision is made for quickly emptying the tank of liquid and chips whenever necessary.

The multiple spindle drill head enables a heavy and comparatively slow-speed drill spindle to revolve much more rapidly a multiplicity of secondary spindles in a supporting device fixed to the spindle arm. This device is very useful in jig work when a number of small holes of differing diameters are to be



THE DEMAND FOR INTERCHANGABLE PARTS HAS STIMULATED THE DEVELOPMENT OF GRINDING MACHINES

Fig. 11—The precision grinder shown above is not new from the standpoint of appearances, its type having been known for some years. However, in order to keep pace with the increasing demands for greater flexibility in grinding wheels, this machine has been redesigned to accommodate a table speed of 30 feet per minute. Prior to the time this was developed the table speed did not exceed 12 feet per minute

Fig. 12—The machine at the right is really a continuous surface grinding machine. The work is bolted to the four work tables, which are carried on a revolving carriage. This carriage is adjustable to height and is of sufficient weight to give the required pressure upon the disk grinding wheel

drilled or counterbored at one operation. By its use a single spindle is readily converted into what is practically a multiple spindle drill at a very moderate expense.

Because of the unusual demand for interchangeable parts in order that they may be rapidly and economically produced and assembled, the question of accuracy is a most important one. The grinding machine appears to be a most promising tool for the quantity production of accurate work. While grinders are by no means new and their usefulness has long been recognized, there still is a field of opportunity for their further development. As in the case of other machines, it may be said that "the best one has not yet been designed." The refinement of dimensions and tolerances made possible by the excellent gages now in use has been an incentive to the attainment of a high degree of accuracy, in which the grinding machine has played a most important part.

With few exceptions the progress in the design of grinding machines has been more in the nature of improvement in detail rather than in the number of entirely new machines developed or the adoption of really new ideas or notable advances in the art of reducing metals to accurate limits by the system of grinding.

Centerless Grinders Appear

However, there are two noticeable exceptions to the foregoing statement. The first of these is an innovation in the practice of grinding. Heretofore all cylindrical work to be reduced to accurate dimensions by grinding was either held on centers or in a chuck mounted on a spindle running in accurately fitted bearings. In the present instance the work is done in a machine without centers or a chuck, and is therefore called a "centerless" grinder. Two different machines of this character have recently been put on the market. One of these is shown in Fig. 10. The principle upon which this machine is constructed is that of a grinding wheel to which is opposed a feed wheel running in the same direction, but at a much slower speed and inclined at a variable angle to determine the rate at which the work is fed past the grinding wheel. Between the grinding and the feed wheels are fixed ways for grinding the work. The work may be fed by hand or automatically from a magazine provided with a chute of suitable form. The feed wheel is supported upon an adjustable carriage controlled by a hand wheel having a graduated dial for controlling the diameter to which the work is to be ground. The carriage is adjustable to govern the speed of the work as it passes in front of the grinding wheel and it may be inclined so as to feed the work either to the right or left. An inspection of some of the work ground in this machine shows satisfactory operation.

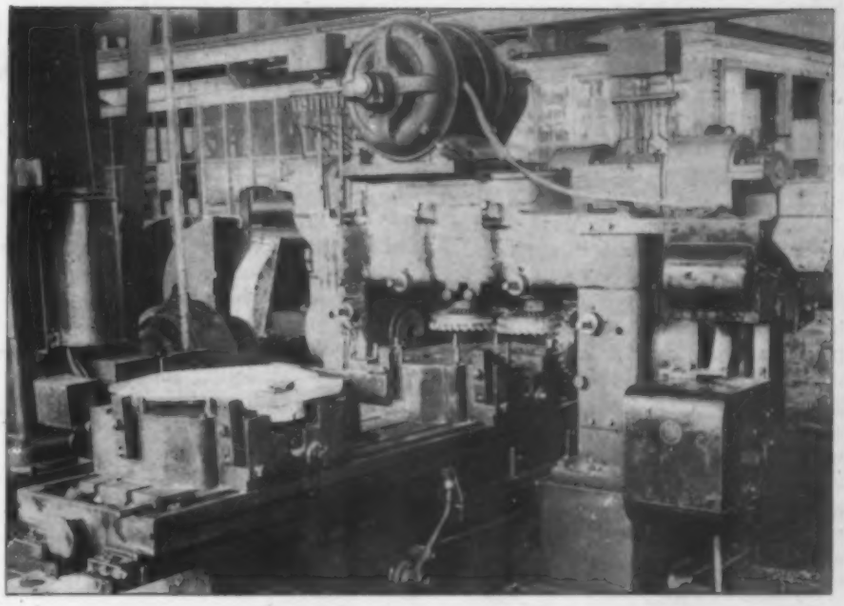


FIG. 14—ONE OF SEVERAL TYPES OF CONTINUOUS MILLERS FOR END FACING—IN ANOTHER MACHINE THE WORK IS CARRIED ON A REVOLVING DRUM

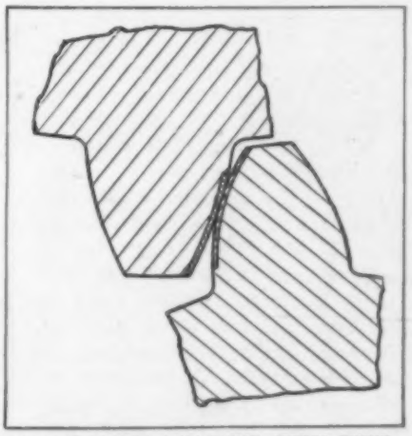


FIG. 15—A NEW DESIGN FOR CUTTER TEETH

FIG. 13—MANY MULTIPLE-SPINDLE MILLING MACHINES FOR CONTINUOUS WORK ARE BEING DEVELOPED—IN SOME DESIGNS A CIRCULAR TABLE IS USED

Another Grinder Without Centers

Another grinding machine has been devised along lines similar to the machine just described, in that it does not hold the work on centers. In place of the feed wheel a feed carriage is provided. It is pivoted and adapted to swing in a vertical plane, to any angle necessary to feed the work at the proper speed in front of the grinding wheel. Adustable guides and supports are provided for holding work of varying diameters. An inspection of work ground on this machine shows it in true cylindrical form and with a fine finished surface. It appears to be capable of handling a large amount of work, particularly of moderate diameters and comparatively short lengths, such as rolls for roller bearings.

The second noticeable improvement in grinding machines has been in the largely increased dimensions and weights, providing greater rigidity, less vibration and consequently greater accuracy. These improvements are paving the way for greater table speeds. Until recently, the possible table speed was limited by the allowable noise and shock at the point of reversal to 12 feet or less per minute. A new device for the reversal of the table has been invented whereby the table speed has been increased to 30 feet per minute, thus very largely increasing the productive

capacity of the machine. This is accomplished by a special device automatically slowing up the table as it approaches the reversing point and accelerating the speed at the beginning of the return stroke. Fig. 11 shows a grinding machine equipped for rapid table speed. The generous proportions of this machine illustrate the tendency to secure greater rigidity.

Fig. 12 illustrates continuous surface grinding machine, in which work bolted on either of the four vertical tables is ground on a horizontal disk wheel. The work tables are supported by a four-arm revolving carriage, which is adjustable to height and of sufficient weight to give the required pressure upon the grinding wheel. This pressure is regulated by a compression spring, while a micrometer stop screw adjusts the machine for the removal of any definite amount of stock desired. The fact that the upper surface of the grinding wheel is used, instead of the under surface, permits of a very low and therefore more rigid construction than the usual form of surface grinding machines, which from the nature of their design must necessarily be of considerable height, and therefore subject to vibration to a much greater extent.

Adapt Millers to Continuous Work

The most prominent feature in the milling machine line is the development of a number of machines of the continuous type, which are the designer's answer to the manufacturer's requests for a machine capable of greater production. This demand has been an entirely legitimate one and is in keeping with the tendency of the times. The great accuracy of the work of the milling machine, particularly when using the various forms of end mills, is its most potent recommendation and brings its output to a perfection rivaled only by the grinding machine. Its ability to produce irregular forms of great variety, places it high up among the leading productive machines in the mechanical world of today. The two prominent types of continuous millers are the vertical and the horizontal types, each best adapted to certain lines of work.

Although in several sizes, milling machines have been adapted to continuous work, there are others which have been specially designed for this purpose. Fig. 13 illustrates a rigid and well proportioned machine. In another machine of similar type, two vertical spindles are provided, one carrying a roughing and one a finishing cutter, so that any surface within the range of the machine may be completely milled without resetting.

Modern manufacturing methods have brought about the increased use of milling machines and often thousands of parts requiring the same marking must be cut to accurate finish length. Forgings, crankshafts, axles, small castings, etc., are examples of this work A milling machine of this type was described in the issue of Dec. 2. This machine has two housings adjustable in relation to each other and each carrying two cutter spindles, one for a roughing and one for a finishing cutter. Between the two housings carrying the four cutter spindles is a work-carrying fixture of cylindrical form, supported by a heavy shaft passing through both housings and rotated through the medium of a large worm gear device at the left.

Costs Force Raise

TWO years ago the cost of delivering THE IRON TRADE REVIEW *to a single subscriber for one year was* $14.24. *Today this cost is* $27.42, *an increase of* $13.18.

These figures include only the paper, mechanical, printing and mailing expenses. Other charges such as editorial and correspondents' salaries, engravings, overhead, etc., are not included in this compilation.

While publishing costs were piling up increases of from 200 *to* 300 *per cent, the subscription price of* THE IRON TRADE REVIEW *was advanced only* 25 *per cent. And to add to other burdens of the publishing business, the government by the introduction of the zone system, increased mailing charges from* 50 *to* 700 *per cent, depending on the distance the periodical is mailed.*

With this issue, the subscription price of THE IRON TRADE REVIEW *is increased from* $5 *to* $6 *a year, which still leaves a difference in favor of the subscriber of* $21.42.

Chuck Consists of Three Plates

A novel type of continuous milling machine originally designed for castellating small nuts, recently was developed. As first constructed it consisted essentially of a continuously rotating chuck consisting of three plates. The left hand plate being fixed to the work-carrying shaft. The center plate is of a proper diameter to provide a support for the parts to be milled. The right hand plate is slotted on its inner side to suit the work to be held. It runs loose on the shaft upon which it is permitted to swivel or tilt. The three plates forming the chuck rotate between two steel rollers located at the point where the work first comes in contact with the milling cutters. A spreading device is located where the work is to be put into the chuck to facilitate its introduction.

A more recent development of this machine has been to provide two work-holding Chucks, thus doubling its productive capacity. The construction of the chucks is similar to the single chuck and the operation of the machine is practically the same. The chucks can be readily removed and others adopted to a different form or class of work substituted.

The great importance of the milling machine in the manufacture of interchangeable parts for a large class of machinery has long been recognized. In the early types of machines with the fine toothed cutters the work was of not much greater value than if made with so many saws. Gradually the number of teeth was reduced and their form much improved. With a hand scraper the teeth were "backed off" or relieved. Wide faced cutters for milling plane surfaces were tried with indifferent success. Then some ingenious mechanic devised the helical toothed cutter, probably getting his idea from the angular smoothing tool used on the planer. This produced much better work. Next came the forming cutter, by which irregular surfaces were milled, and with it came the problem of chattering, similar to that of the old straight toothed cutter, only worse. Many forms and devices have been used to avoid this trouble and to produce really smooth work.

New Cutter Form Developed

In recent months much experimental work has been done along this line and at last a cutter has been developed which is thought to be unusually near perfection. In consists of a formed cutter with helical flutes and the teeth are relieved in a mechanical and scientific manner. The outline of the cutter teeth is shown in Fig. 15. This form permits the making of pinions with as few as five teeth, still preserving the much desired rolling contact over a large portion of the faces and flanks of the teeth.

There are many more or less important improvements in machines that have doubtless rendered them more useful and practical and many machines that have been brought out are but little different in principle and design from those that have gone before. However, it is evident that the builders and designers of machine tools are fully alive to the demand for machines of greater productivity and accuracy as a means of reducing manufacturing costs, and the record of the coming year in this respect bids fair to rival that of the year just closed.

Have We Too Many Rolling Mills?

Expansion in the Country's Steelmaking Capacity Last Year Places the National Ingot Output at 53,500,000 Tons—Number of Rolling Mills Laid Down and Now Building Is Startling

BY JOHN D. KNOX

PROMISED additions to the country's steelmaking capacity during the new year are less favorable, from the standpoint of tonnage, than they have been since 1913. Costs of construction and materials have soared over the last 12 months to such an extent that a new open-hearth furnace today would cost easily 125 per cent more than one built two years ago. Undoubtedly this factor has exerted a curbing influence on new construction plans. At present 12 open-hearth furnaces are under construction, as shown in Table III, their rated annual capacity being 665,000 tons.

The number of open-hearth furnaces building Jan. 1, 1920 was 25, having a total rated capacity of 1,392,000 tons annually. Two years ago at the beginning of 1919, 12 furnaces with a total yield of 1,005,000 tons, were included in the building program. At the opening of 1918 the number of steelmaking units in course of erection totaled 27 and promised the addition of 1,530,000 tons to total ingot capacity. On Jan. 1, 1917 construction work had been started on 95 furnaces of 4,795,500 tons capacity. The number of open-hearth furnaces completed since 1913 together with their annual rated output and the country's estimated ingot production follows:

Year	Number of furnaces	Gross tons	National ingot cap.
1920	26	1,268,000	53,500,000
1919	23	1,871,000	52,200,000
1918	39	2,192,500	50,500,000
1917	101	5,413,000	48,500,000
1916	105	4,300,000	43,000,000
1915	43	1,759,000	39,000,000
1914	9	507,000	37,500,000
1913	62	3,120,000	37,000,000

Expansion of America's steel producing capacity during the past year netted the industry 1,268,000 tons. This increase in open-hearth steel represents a total of 26 furnaces which began melting for the first time. Compared with 1919 when 23 new open hearths with an aggregate output of 1,871,000 tons annually were charged, the coming capacity for 1920 was 503,000 tons less. The decrease in last year's tonnage from 1919 is due to the fact that the 23 new open-hearth furnaces placed in operation during 1919 had an average rating of 117 tons while those started during 1920 were rated at 70 tons average. Table II shows the details by companies, the number of furnaces built and the increased steel ingot capacity for 1920.

The construction of 1,268,000 tons of new capacity last year brings the estimated total capacity at the opening of the new year to 53,468,000 tons. The output of the new units compared with reports covering the last six years places 1920 as the second lowest year on the list. The year of 1914 shows the lowest record and only nine new open-hearth furnaces with an aggregate capacity of 507,000 tons were added in that period. The record made in 1917, when 101 furnaces with an annual capacity of 5,413,000 tons were placed in commission, continues to stand out prominently.

Table I

Recapitulation

	1920 Completed	1920 Building
BY-PRODUCT OVENS	1213	370
BLAST FURNACES	6	4
OPEN-HEARTH FURNACES	26	12
ROLLING MILLS:		
Band	0	1
Bar	8	3
Billet	0	4
Black plate	41	1
Blooming	2	2
Hoop	0	1
Merchant	12	6
Plate	1	1
Rod	1	1
Sheet, hot	82	101
Sheet, cold	87	48
Sheet and tin bar	0	5
Skelp	0	2
Strip, hot	0	5
Strip, cold	1	35
Tube, lapweld	2	2
Tube, buttweld	0	1
Tube, seamless	1	1
Universal	2	2
Wheel	0	2
Wire	2	2
Total	241	224
ELECTRIC FURNACES:		
Booth	1	
Greaves-Etchells	4	
Greene	5	
Heroult	13	
Ludlum	2	
Moore	4	
Rennerfelt	1	
Snyder	2	
Unclassified	6	
Total	38	

Expansion in the iron and steel industry during the past six years has been principally in steel ingot capacity. During the past two years, however, extensive additions to rolling mill capacity were made. The number of new rolling mills placed under power during 1919 aggregated 50 of various types. The output of steel from these mills evidently was insignificant in meeting consuming demands for when 1920 closed 240 additional rolling mills of various kinds had been completed.

Sheet Mills Still Lead

Of the various types of mills installed during 1919, the hot sheet mill was in the majority, 22 stands of rolls having been operated for the first time. This type of mill, as shown in Table VIII, again topped last year's list when 62 new units began finishing operations. Of this number it is estimated that the rolling schedule of 34 mills will be confined to the forming of the more common grades of sheets and 28 mills to the production of highly finished sheets used in the fabrication of metallic furniture, enamelware and certain parts of automobiles, stoves, etc. The country's annual sheet output, therefore, is estimated to have been increased 380,000 tons as a result of the 62 mills laid down last year.

When it is recalled that the Mahoning valley, the largest sheet producing district in the United States, has a total of 105 mills capable of producing 643,400 tons of sheets annually, the number of sheet mills now under construction is remarkable. Also interesting is the fact that with the completion in 1921 of the Republic Iron & Steel Co's. eight new mills, the Mahoning valley will have a total of 113 stands of hot sheet mill rolls. This company then will become the second largest sheet producer in that district, the Brier Hill Steel Co. being first with 28 mills, the Trumbull Steel Co. third with 17 mills, the Youngstown Sheet & Tube Co. fourth with 15 mills, the Newton Steel fifth with 10 mills, the Sharon Steel Hoop Co. sixth with nine mills, and the Falcon Steel Co. and the Mahoning Valley Steel Co. tied for seventh place with eight mills each. The annual sheet capacity of the Mahoning valley also will be increased from 643,000 to 703,400

tons when the eight new mills of the Republic Iron & Steel Co. start rolling.

The number of rolling mills under construction at the end of 1919 was surpassed by that building at the end of 1920, the totals being 168 and 224 respectively. Nearly 50 per cent in the case of 1919 and about 45 per cent in the case of 1920 of the mills under construction were adapted to the rolling of sheets. Of these were 83 ready to operate after Jan. 1, 1920 and 101 after Jan. 1, 1921. The expected increase in the total 921 sheet output, therefore, is estimated at 620,000 tons. In other words, the increased tonnage to be offered by the 101 mills represents nearly 30 per cent of the total output of the sheet mills in this country during 1919.

Estimated pig iron output of the six new stacks completed during 1920 totaled 1,138,500 tons, as shown in Table IV, an increase of 741,750 tons over the estimate for the two new stacks blown in during 1919. While Table V shows that four new blast furnaces with an annual capacity of 690,000 tons now are under construction, only one of these stacks, that of the Trumbull-Cliffs Furnace Co., can be considered as increasing the national pig iron capacity. The new stack of E. W. Mudge & Co. will replace the company's Claire furnace at Sharpesville, Pa., while the two new stacks of the Replogle Steel Co. replace Nos. 1, 2 and 3 Wharton, N. J. stacks, which were torn down during 1919 and 1920. Stacks dismantled during 1920 include "C" furnace of the Colorado Fuel & Iron Co., Pueblo, Col. and the Wayne stack of the Detroit Furnace Co., Detroit.

Blast furnaces, which were remodeled during 1920 or now are being remodeled, include one each unless otherwise signified at the following plants: No. 2 stack, Carnegie Steel Co., Farrell, Pa.; E. & G. Brooke Iron Co., Birdsboro, Pa.; No. 2 Crane furnace, Empire Steel & Iron Co., Catasauqua, Pa.; the Thomas Iron Co., Hokendaqua, Pa.; the Eastern Steel Co., Pottstown, Pa.; Nos. 2 and 3 stacks, Carnegie Steel Co., Duquesne, Pa.; No. 3 stack, National Tube Co., McKeesport, Pa.; Thomas Furnace Co., Milwaukee; Internont Coal & Coke Corp., Big Stone Gap, Va.; Mississippi Valley Iron Co., St. Louis; East stack, American Rolling

Table II

Open Hearths Completed During 1920

Company	No. of furnaces	Rated capacity, tons	Annual capacity, tons
Bethlehem Steel Co., Sparrows Point, Md.	1	300	120,000
Black Steel & Wire Co., Kansas City, Mo.	2	75	100,000
Drain Steel Co., Moore, Pa.	2	65	85,000
Follansbee Brothers Co., Follansbee, W. Va.	4	40	120,000
Heppenstall Forge & Knife Co., Pittsburgh	1	25	22,000
Interstate Iron & Steel Co., South Chicago, Ill.	2	75	100,000
Judson Mfg. Co., Emery, Cal.	1	50	35,000
Kansas City Bolt & Nut Co, Kansas City, Mo.	2	50	70,000
Lukens Steel Co., Coatesville, Pa.	2	90	130,000
Stanley Works, New Britain, Conn.	1	25	22,000
Wayne Steel Co., Erie, Pa.	2	25	44,000
Weirton Steel Co., Weirton, W. Va.	5	100	350,000
Worth Steel Co., Claymont, Del.	1	100	70,000
Total	26		1,268,000

Table III

Open Hearths Building Dec. 31, 1920

Company	No. of furnaces	Rated capacity, tons	Annual capacity, tons
Kansas City Bolt & Nut Co., Kansas City, Mo.	1	50	35,000
Mansfield Sheet & Tin Plate Co., Mansfield, O.	4	75	200,000
Naval Ordnance Factory, S. Charleston, W. Va.	2	60	80,000
Weirton Steel Co., Weirton, W. Va.	2	100	140,000
Worth Steel Co., Claymont, Del.	3	100	210,000
Total	12		665,000

Table IV

Blast Furnaces Completed During 1920

	Number of furnaces	Daily capacity, tons	Annual capacity, tons
Alan Wood Iron & Steel Co., Swedeland, Pa.	1	500	172,500
Bethlehem Steel Co., Sparrows Point, Md.	1	500	172,500
Ford Motor Co., Detroit	2	600	414,000
Pittsburgh Crucible Steel Co., Midland, Pa.	1	600	207,000
St. Louis Coke & Chemical Co., Granite City, Ill.	1	500	172,500
Total	6		1,138,500

Table V

Blast Furnaces Building Dec. 31, 1920

	Number of furnaces	Daily capacity, tons	Annual capacity, tons
*Mudge, E. W., & Co., Sharpesville, Pa.	1	400	138,000
**Replogle Steel Co., Wharton, N. J.	2	500	345,000
Trumbull-Cliffs Furnace Co., Warren, O.	1	600	207,000
	4		690,000

*Replaces Claire stack.
**Replace Nos. 1, 2 and 3 Wharton stacks.

Table VI

By-Product Ovens Completed in 1920

Company	Number of ovens	Type of ovens	Est. annual coking cap., tons
Bethlehem Steel Co., Sparrows Point, Md.	120	K	520,000
Birmingham Coke & By-Product Co., Birmingham, Ala.	50	K	[illegible]
Cambria Steel Co., Johnstown, Pa.	60	C-B	180,000
Domestic Coke Corp., Fairmont, W. Va.	60	K	260,000
Donner Union Coke Corp., Buffalo	150	K	650,000
Ford Motor Co., Detroit	120	S-S	621,960
Jones & Laughlin Steel Co., Hazelwood, Pa.	60	K	260,000
Lackawanna Steel Co., Buffalo	60	S-S	310,980
Pittsburgh Crucible Steel Co., Midland, Pa.	100	K	435,000
Sloss-Sheffield Steel & Iron Co., Birmingham, Ala.	120	S-S	621,960
St. Louis Coke & Chemical Co., Granite City, Ill.	80	R	358,400
Steel & Tube Co. of America, Indiana Harbor, Ind.	120	S-S	621,960
Steel & Tube Co. of America, Mayville, Wis.	36	U-O	115,670
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.	77	K	345,000
Total	1213		5,840,510

Type of ovens: K, Koppers; S-S, Semet-Solvay; C-B, Cambria-Belgium; R, Roberts; U-O, United Otto.

Table VII

Ovens Building Dec. 31, 1920

Company	Number of ovens	Type of ovens	Est. annual coking cap., tons
Cambria Steel Co., Johnstown, Pa.	120	S-S	621,960
Chicago By-Product Coke Co., Chicago	100	K	435,000
Milwaukee Coke & Gas Co., Milwaukee	150	K	650,000
Total	370		1,706,960

Equipment Completed or Building in 1920

Table VIII

Rolling Mills Completed During 1920

Company	Number stands	Type mill
American Rolling Mill Co., Middletown, O.	4	30" Sheet
American Rolling Mill Co., Middletown, O.	10	26" Cold rolls
American Sheet & Tin Plate Co., Gary, Ind.	24	28" Black plate
American Sheet & Tin Plate Co., Gary, Ind.	42	24" Cold rolls
American Steel Co., Waynesburg, Pa.	1	28" Sheet
Apollo Steel Co., Apollo, Pa.	6	28" Sheet
Apollo Steel Co., Apollo, Pa.	2	26" Cold rolls
Bethlehem Steel Co., Bethlehem, Pa.	1	42" Shape
Bethlehem Steel Co., Sparrows Point, Md.	1	60" Universal
Bethlehem Steel Co., Sparrows Point, Md.	12	28" Black plate
Bethlehem Steel Co., Sparrows Point, Md.	10	Sheet
Bethlehem Steel Co., Sparrows Point, Md.	9	Cold rolls
Black Steel & Wire Co., Kansas City, Mo.	1	Rod
Cambridge Steel Co., Cambridge, O.	1	14" Merchant; rerolling
Canonsburg Steel & Iron Co., Canonsburg, Pa.	2	28" Sheet
Capital City Iron & Steel Co., Harrisburg, Pa.	1	9" Belgian bar
Chemung Valley Steel Co., Elmira Heights, N. Y.	1	8" Merchant
Columbia Steel Co., Pittsburg, Cal.	1	10" Merchant
Columbia Steel Co., Pittsburg, Cal.	1	12" Merchant
Detroit Seamless Tube Co., Detroit	1	Tube, seamless
Eastern Rolling Mill Co., Baltimore	8	30" Sheet
Eastern Rolling Mill Co., Baltimore	4	30" Black plate
Eastern Rolling Mill Co., Baltimore	20	26" Cold rolls
Electric Steel & Forge Co., Cleveland	1	16" Bar
Electric Steel & Forge Co., Cleveland	1	10" Bar
Electric Steel & Forge Co., Cleveland	1	8" Bar
Falcon Steel Co., Niles, O.	8	29" Sheet
Falcon Steel Co., Niles, O.	4	24" Cold rolls
Gulf States Steel Co., Alabama City, Ala.	1	20" Merchant
Hoosier Rolling Mill Co., Terre Haute, Ind.	1	22" Merchant
Illinois Steel Co., South Chicago, Ill.	1	10" Merchant
*Jones & Laughlin Steel Co., Pittsburgh	1	32" Universal
Jones & Laughlin Steel Co., Aliquippa, Pa.	1	Tube, lapweld
Judson Mfg. Co., Emery, Cal.	1	16" Merchant
Laclede Steel Co., Madison, Wis.	1	12" Cold strip
Ludlum Steel Co., Watervliet, N. Y.	1	9" Bar
Memphis Iron & Steel Co., Memphis, Tenn.	1	16" Bar
Nagle Steel Co., Pottstown, Pa.	1	54" Plate
Newton Steel Co., Newton Falls, O.	10	28" Sheet
Newton Steel Co., Newton Falls, O.	10	26" Cold rolls
Otis Steel Co., Cleveland	1	30" Sheet
Peerless Drawn Steel Co., Massillon, O.	1	10" Merchant
Peerless Drawn Steel Co., Massillon, O.	1	14" Bar
**Penn Seaboard Steel Corp., New Castle, Del.	1	34" Blooming
Pennsylvania Forge Co., Philadelphia	1	22" Bar
Reeves Mfg. Co., Dover, O.	1	28" Sheet
Scullin Steel Co., St. Louis	1	12" Merchant
Scullin Steel Co., St. Louis	1	22" Merchant
Seneca Iron & Steel Co., Blasdell, N. Y.	2	28" Sheet
Seneca Iron & Steel Co., Blasdell, N. Y.	2	24" Cold rolls
Standard Tin Plate Co., Canonsburg, Pa.	1	29" Black plate
Superior Sheet Steel Co., Canton, O.	8	29" Sheet
Superior Sheet Steel Co., Canton, O.	4	26" Cold rolls
Valley Steel Works, Pittsburgh	1	26" Blooming
Valley Steel Works, Pittsburgh	1	12" Merchant
Watertown Arsenal, Watertown, Mass.	1	30" Sheet
Whitaker-Glessner Co., Portsmouth, O.	4	30" Cold rolls
Youngstown Sheet & Tube Co., Youngstown, O.	1	Tube, lapweld
Total	241	

*Replaces 108" plate mill.
**Replaces 84" plate mill.

Table IX

Rolling Mills Building Dec. 31, 1920

Company	Number stands	Type mill
Acme Steel Goods Co., Riverdale, Ill.	20	10" Cold strip
American Rolling Mill Co., Middletown, O.	4	30" Sheet
American Rolling Mill Co., Zanesville, O.	4	30" Sheet
American Rolling Mill Co., Zanesville, O.	2	30" Cold rolls
American Tube & Stamping Co., Bridgeport, Conn.	1	18" Hot strip
Ashtabula Steel Co., Ashtabula, O.	8	28" Sheet
Ashtabula Steel Co., Ashtabula, O.	4	26" Cold rolls
Carnegie Steel Co., McDonald, O.	1	10" Hoop
Carnegie Steel Co., McDonald, O.	1	18" Band
Cambria Steel Co., Johnstown, Pa.	2	Wheel
Chapman Price Steel Co., Indianapolis, Ind.	4	28" Sheet
Chapman Price Steel Co., Indianapolis, Ind.	2	24" Cold rolls
Collins Co., Collinsville, Conn.	1	Bar
Columbia Steel Co., Pittsburg, Cal.	1	12" Merchant
Ewald Iron Co., Louisville, Ky.	1	8" Bar
Follansbee Brothers Co., Toronto, O.	1	30" Sheet bar
Follansbee Brothers Co., Toronto, O.	10	30" Sheet
Follansbee Brothers Co., Toronto, O.	10	28" Cold rolls
General Steel Co., St. Francis, Wis.	1	24" Billet
General Steel Co., St. Francis, Wis.	1	10" Merchant
Hudson City Steel Corp., Hudson, N. Y.	3	Cold strip
Illinois Steel Co., Gary, Ind.	1	12" Hot strip
Illinois Steel Co., Gary, Ind.	1	20" Hot strip
Indiana Rolling Mill Co., New Castle, Ind.	8	28" Sheet
International Steel Tube Co., Cleveland	1	Tube, buttweld
Interstate Iron & Steel Co., So. Chicago, Ill.	1	12" Bar
Kansas City Bolt & Nut Co., Kansas City, Mo.	1	22" Billet
Mansfield Sheet & Tin Plate Co., Mansfield, O.	1	34" Blooming
Mansfield Sheet & Tin Plate Co., Mansfield, O.	1	24" Sheet bar
Mansfield Sheet & Tin Plate Co., Mansfield, O.	6	30" Sheet
Mansfield Sheet & Tin Plate Co., Mansfield, O.	1	28" Black plate
Massillon Rolling Mill Co., Massillon, O.	12	Sheet
Midvale Steel & Ordnance Co., Coatesville, Pa.	1	Skelp
Milwaukee Rolling Mill Co., Milwaukee	8	28" Sheet
Milwaukee Rolling Mill Co., Milwaukee	4	24" Cold rolls
Minnesota Steel Co., Duluth, Minn.	1	Rod
Nat'l Enamel. & Stamping Co., Granite City, Ill.	6	24" Cold rolls
Nat'l Enamel. & Stamping Co., Granite City, Ill.	10	28" Black plate
Nat'l Enamel. & Stamping Co., Granite City, Ill.	1	24" Sheet bar
National Tube Co., Lorain, O.	2	Tube, lapweld
New Process Iron & Steel Co., Noblesville, Ind.	1	Merchant
Otis Steel Co., Cleveland	8	30" Sheet
Pacific Coast Steel Co., Youngstown, Wash.	1	20" Universal
Pacific Coast Steel Co., Youngstown, Wash.	1	10" Merchant
Pacific Coast Steel Co., Youngstown, Wash.	1	8" Merchant
Pittsburgh Open Hearth Steel Co., Pittsburgh	1	Universal
Reading Iron Co., Danville Pa.	1	18" Skelp
Republic Iron & Steel Co., Niles, O.	8	30" Sheet
Republic Iron & Steel Co., Niles, O.	6	26" Cold rolls
Steel & Tube of America, Indiana Harbor, Ind.	1	Tube, seamless
Steel & Tube of America, Indiana Harbor, Ind.	1	24" Billet
Trumbull Steel Co., Warren, O.	1	14" Hot strip
Trumbull Steel Co., Warren, O.	1	9" Hot strip
Trumbull Steel Co., Warren, O.	12	Cold strip
United Alloy Steel Corp., Canton, O.	1	12" Merchant
Warren Iron & Steel Co., Warren, O.	4	30" Sheet
Warren Iron & Steel Co., Warren, O.	2	24" Cold rolls
Weirton Steel Co., Weirton, W. Va.	1	40" Blooming
Weirton Steel Co., Weirton, W. Va.	1	21" Slab & billet
Weirton Steel Co., Weirton, W. Va.	1	18" Billet & sheet bar
Whitaker-Glessner Co., Portsmouth, O.	1	18" Billet & sheet bar
Whitaker-Glessner Co., Portsmouth, O.	7	30" Sheet
Whitaker-Glessner Co., Portsmouth, O.	12	30" Cold rolls
Worth Steel Co., Claymont, Del.	1	42" Plate
Total	224	

Rolling Mills Projected for 1921

Interstate Iron & Steel Co., Chicago	1	16" Continuous bar
Joliet Forge Co., Joliet, Ill.	1	Bar
National Steel Rolling Co., Baltimore	1	8" Bar, rerolling
National Steel Rolling Co., Baltimore	1	14" Bar, rerolling
Utah Steel Corp., Salt Lake City, Utah	1	8" Merchant
Western Rolling Mill Corp., Seattle	1	22" Structural
Western Rolling Mill Corp., Seattle	1	12" Belgian
Worcester Pressed Steel Co., Worcester, Mass.	1	12" Hot strip
Total	8	

Mill Co., Columbus, O.; described in the Nov. 18, 1920 issue of THE IRON TRADE REVIEW; Belfont Iron Works, Ironton, O., described in the Oct. 21, 1920 issue of THE IRON TRADE REVIEW; Lavino Furnace Co., Sheridan, Pa., described in the Dec. 9, 1920 issue of THE IRON TRADE REVIEW; the Low Moor Iron Co., Covington, Va., described in the Oct. 14 issue of THE IRON TRADE REVIEW; the Leesport Iron Co., Inc., Leesport, Pa.; No. 1 stack, Otis Steel Co., Cleveland; and Ivanhoe Mining & Smelting Corp, Ivanhoe, Va.

America's pig iron capacities in gross tons of all new furnaces placed in blast each year from 1905 to 1920 inclusive, are as follows:

Year	Gross tons
1920	1,138,500
1919	396,750
1918	1,425,000
1917	2,182,500
1916	530,000
1915	530,000
1914	None
1913	550,000
1912	1,000,000
1911	565,000
1910	1,794,000
1909	1,930,000
1908	1,188,000
1907	2,065,000
1906	1,135,000
1905	1,292,000

As shown in Table VI, 1213 by-product coke ovens were completed during 1920, their combined annual coking capacity being estimated at 5,840,510 tons. During 1919, 783 by-product ovens with an annual output estimated at 3,483,505 tons, were completed. The coking capacity added during 1920, therefore, is 430 ovens, yielding 2,357,000 tons, in excess of the number of coke ovens available during 1919. Of the number of new by-product ovens completed during 1920, 20 per cent were built in Alabama; 13 per cent in Pennsylvania; 17 per cent in New York; 10 per cent in Michigan, Maryland and Indiana; 7 per cent in Illinois; 5 per cent in West Virginia; and 3 per cent in Wisconsin. As 1920 closed 370 by-product coke ovens were under construction with an estimated annual coking capacity of 1,706,960 tons.

Production figures for 1919 firmly establish the fact that production of by-product coke in this country has passed permanently that trade in beehive ovens. In 1916 the maximum production of coke made in beehive ovens was reached, the total yield being 25,465,000 tons. During the same year the output of by-product coke was 19,069,000 tons. Production of beehive during 1919 suffered another loss, the total output of this grade of coke for that year being 19,069,000 tons. By-product production for 1919 was recorded as 25,171,000 tons, or 6,102,000 tons in excess of beehive output for the same year. While production figures of beehive and by-product coke are not available for 1920, it is estimated that the former grade will have reached about 20,500,000 tons and the latter about 25,500,000 tons at the close of the year.

In line with open-hearth expansion in 1920, the number of electric furnaces completed also is less than in the year before. Electric melting units installed in 1919 totaled 53. As shown in Table I, 38 electric furnaces were completed in this country in 1920, a decrease of 15 over the year previous. The total number of electric furnaces adapted for melting or refining purposes in this country today is placed at 337.

Only one bessemer plant, that of the Steel & Tube Co. of America, was built during 1920. This plant when completed will include two 15-ton converters, three 20-ton cupolas and a 600-ton hot metal mixer. Its annual output will be 360,000 tons of ingots.

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More Blast Furnaces Blown Out

During December 42 Additional Stacks Cease Operation and Year Ends with Only 213 Making Iron—Both Steelworks and Merchant Stacks Are Affected —1920 Pig Iron Production Surpasses 1919 Output

OUTPUT of coke and anthracite pig iron in December, as a result of curtailed blast furnace operations reached the lowest figure during 1920. The total production was 2,703,872 tons, which compared to the 2,935,081 tons of November, was a drop of 231,209 tons. At the same time the rate of production was the lowest during the entire year.

Total production for 1920 was 36,404,572 tons, a gain of 5,825,842 tons over the 30,578,730 tons of 1919, but

DIVISIONS OF PRODUCTION

1919	Merchant	Non-merchant	Spiegel	Ferro-manganese	Other ferro
Jan...	785,384	2,480,789	15,926	17,212	6,968
Feb...	740,863	2,169,640	6,309	21,221	5,308
March..	740,921	2,315,258	6,146	20,586	5,112
April..	593,655	1,856,802	2,778	16,175	4,964
May...	514,002	1,574,679	4,747	10,883	3,418
June...	436,359	1,647,085	13,361	9,860	7,363
July...	493,505	1,909,537	7,830	10,874	2,466
Aug....	548,425	2,175,517	8,179	9,252	708
Sept...	567,608	1,891,418	4,656	17,108	...
Oct....	574,519	1,269,667	5,074	15,164	...
Nov....	625,925	1,760,754	4,500	15,464	726
Dec....	653,792	1,954,831	4,508	11,210	1,733
Total.	7,274,958	23,005,983	84,014	175,009	38,766
1920					
Jan....	716,574	2,267,747	5,903	18,054	4,095
Feb....	735,707	2,215,079	11,755	18,015	3,701
March..	863,187	2,474,018	15,472	19,203	3,908
April..	761,331	1,958,535	6,600	18,036	8,168
May...	808,751	2,140,346	10,744	21,536	10,448
June...	769,236	2,233,565	8,510	26,870	8,442
July...	791,440	2,209,128	6,925	28,347	8,078
Aug....	823,495	2,276,433	8,333	28,642	8,633
Sept...	798,111	2,277,607	11,849	27,697	9,044
Oct....	818,166	2,430,656	9,000	25,786	4,733
Nov.	702,888	2,184,068	11,006	26,068	5,546
Dec..	588,995	2,097,710	4,646	28,111	4,410
Total	9,179,987	26,771,041	110,743	283,595	79,260

a loss of 2,032,876 tons from the 38,437,448 tons made in 1918. Second half 1920 production with 18,241,056 tons was better than the first half production of 18,163,516 tons. Ferromanganese totaled 283,595 tons and was a gain of 108,586 tons over the 175,009 tons of the previous year. Spiegeleisen also with 110,743 tons made a gain of 26,729 tons over the 84,014 tons of 1919.

As was the case during the two previous months, stack activities in December were further curtailed. On Dec. 31, 213 stacks were in operation, compared with 255 on Nov. 30, the net loss being 42 stacks. This is the lowest number of furnaces operating since September, 1919. Of the merchant class no stacks were blown in, but 23 stacks were blown out. Of the nonmerchant class, two were blown in and 21 blown out, with a net loss of 19 stacks. Merchant furnaces in December produced 588,995 tons, a loss of 116,019 tons from

AVERAGE DAILY PRODUCTION

	1920	1919	1918	1917	1916
Jan.	97,172	106,654	77,523	101,930	102,319
Feb.	102,904	105,270	82,794	94,641	106,157
Mar.	108,895	99,614	103,548	105,026	107,343
April	91,754	82,479	109,112	110,936	107,517
May	96,510	67,991	111,351	110,119	108,535
June	101,553	70,467	110,538	108,675	107,127
July	98,190	78,200	109,954	107,659	103,907
Aug.	101,468	88,453	108,983	104,483	103,156
Sept.	104,143	82,692	113,774	104,691	106,935
Oct.	106,075	60,142	112,335	106,332	113,167
Nov.	97,836	80,244	111,595	106,620	110,593
Dec.	87,221	84,711	110,602	93,077	102,715
Av.	99,466	83,910	105,290	104,502	106,610

the 705,014 tons of November. On an average daily basis the December figure was 18,999 tons and the November figure, 23,500 tons, the daily loss being 4501 tons. Steelworks or nonmerchant furnaces produced 2,097,710 tons in December, compared with 2,190,217 tons in November, a loss of 92,507 tons. The average daily output of steelworks stacks was 67,636 tons in December and 73,007 tons in November, a loss of 5371 tons.

The average of all furnaces during December was 87,221 tons compared with 97,836 tons for November, a loss of 10,615 tons per day.

Ferromanganese with 28,111 tons in December, showed a gain of 4813 tons over the November figure of 23,298 tons. Spiegel with a total of 4646 tons, showed a decrease of 6360 tons from the November output.

Pipe Is Reduced

Pittsburgh, Jan. 4.—Other makers of steel pipe including the Youngstown Sheet & Tube Co. and the Central Tube Co. have followed the original action of the Republic Iron & Steel Co., Youngstown, O., in reducing prices, effective Dec. 31, on all kinds and sizes of steel pipe, including oil country tubular goods, returning to the March 21, 1919 basis, or the same as that maintained by the National Tube Co. This card carries a base discount of 57½ per cent off on standard black buttweld pipe and 44 per cent off on galvanized buttweld pipe, ¾ to 3 inches, and the reduction on this grade is $7 a ton, the Republic company having carried a discount of 54 per cent off on black buttweld. The reduction in lapweld pipe is $10 a ton. Iron pipe makers also are expected soon to announce reductions.

Bethlehem Cuts Wages

New York, Jan. 4.—The Bethlehem Steel Corp. has reduced wages 10 to 20 per cent applying to employes of all works, effective Jan. 16. The reductions for tonnage men in some cases will be greater.

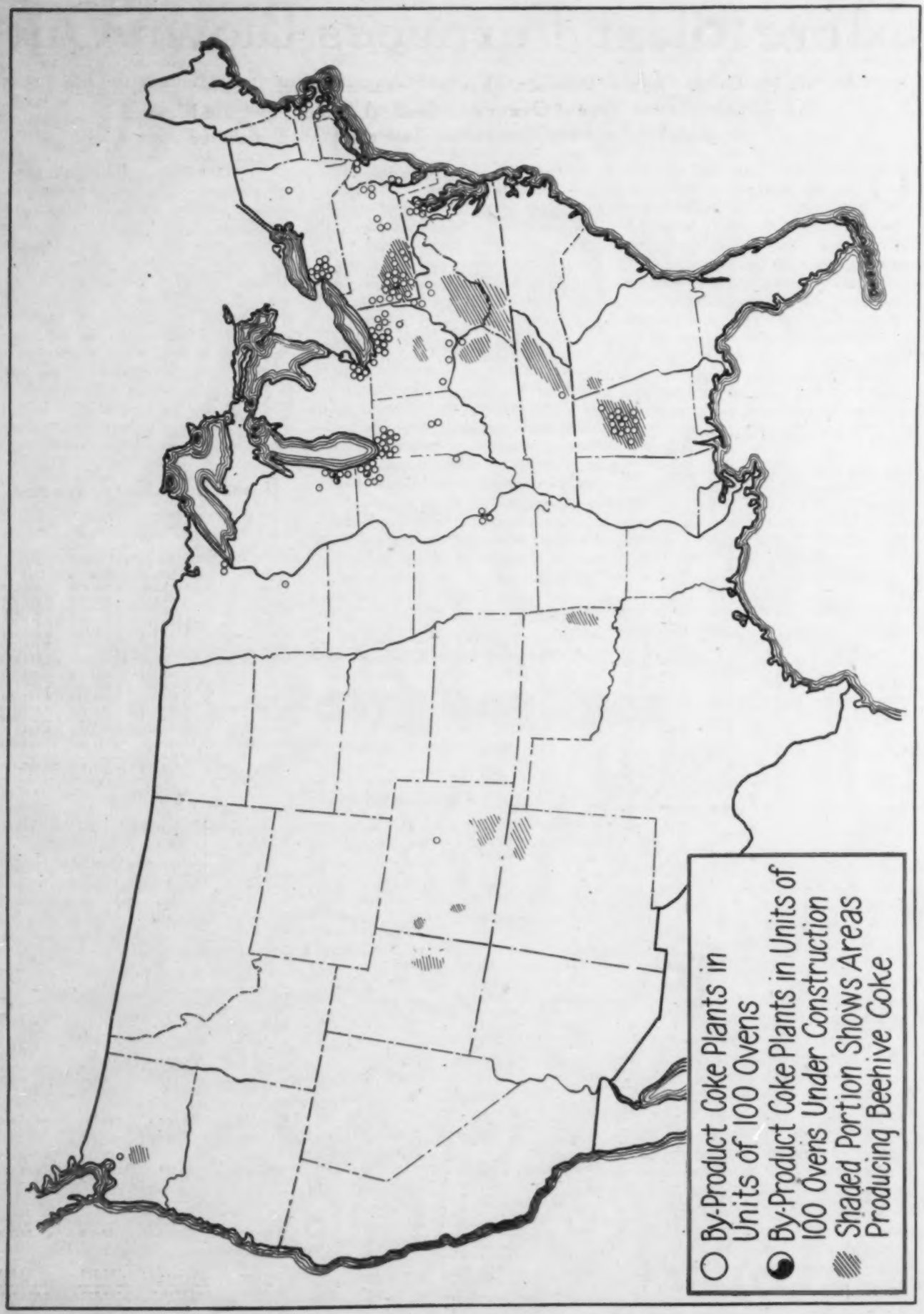
The Steel corporation has decided on 81 as the price at which it will accept common stock subscriptions from its employes.

MONTHLY PRODUCTION

	1920	1919	1918
January	3,012,373	3,306,279	2,403,227
February	2,984,257	2,943,347	2,318,202
March	3,375,768	3,088,023	3,209,996
April	2,752,670	2,474,374	3,273,355
May	2,991,825	2,107,729	3,451,884
June	3,046,623	2,114,023	3,316,148
Total 1st half..	18,163,516	16,037,988	17,972,852
July	3,043,918	2,424,212	3,408,584
August	3,145,536	2,742,081	3,378,479
September	3,124,308	2,480,790	3,413,223
October	3,288,341	1,864,424	3,482,392
November	2,935,081	2,407,369	3,347,844
December	2,703,872	2,626,074	3,434,114
Total 2nd half.	18,241,056	14,544,950	20,464,636
Grand total..	36,404,572	30,578,730	38,437,448

DECEMBER PIG IRON

States	No. of Stacks	No. in blast last day of month December	November	Total tonnage made—Merchant	Nonmerchant	Totals—December	November
Pennsylvania	161	76	99	140,711	766,738	907,449	1,010,977
Ohio	79	51	56	131,420	580,570	711,990	721,641
Alabama	45	16	19	78,710	77,001	155,711	167,447
Virginia	19	8	8	26,437	.....	26,437	33,377
New York	28	16	18	95,476	108,334	203,810	213,889
New Jersey	5	0	2	4,890	.....	4,890	9,157
Illinois	25	17	16	32,476	229,220	261,696	274,898
Colorado	6	4	4				
Indiana	16	13	13	29,380	259,630	289,010	325,440
Maryland	6	1	2				
Wisconsin	6	2	3				
Kentucky	7	0	2				
West Virginia	5	3	4	23,767	35,259	59,026	68,146
Tennessee	16	3	3				
Washington	1	0	0				
Georgia	2	0	0				
Texas	1	0	0				
Minnesota	3	3	3	25,728	40,958	46,686	70,259
Michigan	3	1	2				
Missouri	1	1	1				
Spiegel and ferro—all states	..	..	..	.....	.....	37,167	39,850
Totals	435	213	255	588,995	2,097,710	2,703,872	2,935,081


By-Product Coke Plants in Units of 100 Ovens
By-Product Coke Plants in Units of 100 Ovens Under Construction
Shaded Portion Shows Areas Producing Beehive Coke

Coke Practice Changes Rapidly

By-Product Output Again Exceeds That of Beehive—Steel Industry Continues Expansion of Newer Type of Ovens and Gradual Abandonment of Method by Which Iron and Steelmaking Largely Was Developed

BY MYERS L. FEISER

BY-PRODUCT coke manufacture, having attained a majority of output when it passed the production of beehive coke in 1919, again proved its supremacy in 1920 when it exceeded the previous year's record by an amount estimated up to 8,000,000 tons. In the years previously when beehive tonnage was the greater the rapid strides in by-product output, impressive as they were, failed to bring out definitely the certainty that the more modern process some day permanently would dominate the industry.

That day now having arrived, the second year when the by-product output had the field shows clearly the waning factor of beehive fuel in the ratio of total coke production. The steel industry, having based its development largely on the output of the pioneer coke making process, fast is abandoning the beehive method for the by-product and is building the newer type of ovens in places far removed from the coal mines.

Vast outlays of capital are required for the building of modern coke plants but the returns justify the investment. The size of the investment, however, limits the field of those who may erect modern coke works. For this reason only the larger steel companies mainly have carried on the rapid expansion in the number of by-product ovens in the United States. Other factors aside from steelmaking, however, have been partly responsible for the growth of the retort ovens. These are the drug and chemical trades and the domestic and industrial requirements for gas fuel.

By-Product Grade Sold Up

The output of by-product coke goes almost entirely into the steel and foundry industries. The steel companies which have built their own by-product plants use practically their whole production. Only the coke output of gas and chemical producers finds its way into the open market. Most of the coke sold in the open market comes from the merchant beehive ovens. Many steel companies still are producing large quantities for their own need. In 1919, out of a total of 15,463,649 tons of coke produced by the United States Steel Corp., for its own use, 5,933,056 tons was beehive.

While the year is too young for the collection of 1920 production reports from beehive and by-product operators, the United States geological survey from reliable reports estimates the year's by-product output at 29,000,000 tons. The survey's weekly production figures for beehive coke to Dec. 18 put the 1920 mark at 20,274,000 tons. At that rate the total output for the year of beehive coke would be approximately 21,000,000 tons. Combined, these outputs total 50,000,000 tons, the fourth largest annual production of coke in the history of the industry.

Abandoning Old Coke Field

The development of the by-product coke oven has been responsible, to a large extent, for the expansion of the iron and steel industry beyond the formerly essential proximity to coal fields. The map on the preceding page shows the location of a vast number of retort ovens at varying distances from the coal producing centers. It is true a large number of by-product ovens have been and are being built where beehive coke making has flourished, but this has been due largely to the fact that steelworks and blast furnaces located earlier in these sections and expanded to meet growing needs have required the more economical coking process to add to the available fuel supply.

The states which are producing by-product coke, according to the latest available figures, eclipse those where the beehive fuel is made. In the accompanying map, 19 states are shown with by-product plants while only 13 states embrace beehive operations. Eight states contain ovens of both types. This leaves five states in the beehive group where the by-product ovens have not yet appeared and 11 in which expansion of the newer type of ovens has reached sections of the country where coke making formerly was unknown.

The scattered locations of by-product plants have been welcomed by consumers of coke generally. The expansion of the steel and foundry industries beyond the Pittsburgh district increased the freight haul of coke from the Connellsville fields and demanded supplies nearer at hand. The building of by-product ovens near the consuming points has kept down freight bills and reduced the danger of interruption of supplies through transportation congestion. It has tended to decentralize industry. With the national tendency more and more toward conservation of national resources, especially in by-product recovery, the further decentralization of the coke, steel and allied industries may be looked for.

The quality and quantity of coke to be used in the production of steel, and at the same time to provide gas for steelworks fuel, is largely influenced by the grade of coke used. Although the first cost of a by-product coke plant is large, it is, to quote a by-product plant authority, only "a fraction of the value of the pig iron made from its coke in one year."

Development in the manufacture of both coke and gas has resulted in the perfecting of the modern by-product coke oven. The growth of the chemical industries has followed the expansion of this coke making process. At the time coke alone was required, the beehive oven, inexpensively built and located close to coal mines filled the bill. The simple gas retort was sufficient when only illuminating gas was required. But today the national demand for conservation and greater industrial efficiency requires something more economical and productive in its operatons. This is the by-product plant.

Financial Return Is Large

The volatile matter in coal which is totally lost in the beehive oven, contains many valuable substances which, when recovered in the modern by-product plant, have been largely responsible for the development and growth of the drug, chemical, dyestuffs and other industries. The gas produced in the manufacture of coke in by-product ovens constitutes a considerable portion of the fuel used in the manufacture of steel and many other products made in the vicinity of by-product plants. Surplus gas is an important factor in domestic fuel consumption.

The recovery of by-products brings to the producing works fully a third

of their revenue. In 1917, according to the latest available government figures, the by-product return was more than $67,000,000. The 22,000,000 odd tons of coke manufactured in by-product plants that year made up the balance of the $206,313,000 income reported by the by-product plant operators. Just what these values were under the prices fixed by the government in 1918 and at the higher levels prevailing in 1919 and 1920 is yet to be stated. It is expected they would, especially in 1919 and 1920, greatly overshadow the 1917 record of earnings.

That the percentage of coke obtained from coal used in its production is higher in by-product than in beehive ovens, is a well known fact. To quote the United States geological survey:

"The yield of coke from by-product ovens may be decreased or increased within certain limits by changing the relative proportions of high-volatile or low-volatile coals used in preparing the coking mixture. It is therefore possible so to operate a by-product plant that a maximum yield of coke or of by-products may be obtained, the choice of methods being dependent upon the relative market prices prevailing.

"A given quantity of coal will, on the average, produce about 11 per cent less coke in a beehive oven than in a by-product oven, owing to the partial burning of the coal which takes place in beehive ovens. It is probable, therefore, that the coal coked in 1917 would have yielded 3,900,000 more tons of coke than was produced if it had all been coked in by-product ovens."

Would Have Been 60,000,000 Tons

According to this estimate, the total coke production in the United States in 1918, the year of the large coke yield from all ovens, would have been 59,840,490 net tons, had it all been manufactured in by-product ovens. Today's capacity would have manufactured approximately 80 per cent of the output last year.

The manufacture of by-product coke first was undertaken in the United States in 1893. In that year 12 ovens, in a battery built by the Semet-Solvay Co. at Syracuse, N. Y., produced 12,850 net tons. This was 0.1 per cent of the total coke output in that year. In 1900 the by-product coke output first crossed the 1,000,000 tons mark, overreaching it by 75,727 tons. This was a substantial increase at that time, and the total was 5.2 per cent of the year's entire production.

From then until 1908 by-product coke gained steadily. In the year a small loss was shown because of industrial conditions. Then a steady advance in production was resumed with only two periods, 1914 and 1919, falling behind the years immediately preceding. At no time, however, as far as available statistics show, has the by-product percentage of the total coke production of the United States been less than in any previous year. Always this has advanced until in the past year it had reached approximately 58 per cent.

Beehive coke production was begun in the United States prior to 1880 but statistics showing output, number of ovens, etc., are not available for any period earlier than that. In that year, however, 12,732 beehive ovens produced 3,338,300 net tons. In the next 10 years 24,826 additional ovens were built and production attained the record of 11,508,021 tons.

In another decade, total coke production in the country had reached 20,533,348 tons from 43,039 active ovens, including 1,075,727 tons of by-product fuel. At that time there was a total of 57,309 beehive coke ovens in the United States and 1085 retort or by-product coke ovens. Starting in 1900, beehive coke production made intermittent progress, reaching 35,464,224 tons in 1916. This with 91,581 ovens is probably the highest point beehive output ever will attain.

The production of beehive coke in 1907, 35,171,665 tons, is the second high point in history. At that time the country possessed 95,996 beehive ovens. In the accompanying table the output of beehive coke for a period of years is given.

From the construction of the first unit down to 1911 the number of beehive ovens increased steadily. From 1900 to 1910 it grew from 57,309 to 100,362. Not all of this capacity was in operation during that time as may be seen from the fact that with 100,362 beehive ovens and 4078 by-product ovens in the United States in 1910, the total number of both types fired in that year reached only 96,067.

Beehive Ovens Growing Fewer

As steadily as the number of beehive ovens had grown prior to 1911, so has it dwindled in each subsequent year. Based on the rate of recession since 1910, the number of beehive ovens available for coke production last year is estimated at only 82,000. In the accompanying table the decreasing number of beehive coke ovens is given.

The development of the by-product coke oven is as interesting if not more so than of the beehive. Twelve ovens in 1893 represent the original construction, only 0.0011 per cent of the number of by-product ovens available for coke making today. Here, too, steady increases have been made in the number of ovens. This was 1085 in 1900. In 1910 the total was 4078. The combined batteries of by-product coke plants for each successive year are shown in the table.

Within the past three years by-product production has shown a remarkable increase. In 1917, beehive coke output led by-product by 10,727,268 tons. Last year by-product was 8,000,000 tons ahead. This is a clear gain of 18,727,268 tons in three years.

Abandonment of beehive ovens in considerable numbers every year is due chiefly to the fact the steel manufacturers themselves, large owners of coal mines and coke ovens, have determined upon the greater adoption of the by-product plant. This is because of the greater economic and financial returns which are available with the new type as compare with the old.

The world war witnessed perhaps the greatest expansion in the by-product coke industry. At the end of 1914, there were only 5809 by-product ovens in the United States. This was 21 years after the first ovens of this type were built in this country. At the end of 1918, within a few weeks of the termination of actual conflict, the number of by-product ovens had grown to 9279. Production of by-product coke had expanded 14,072,000 tons in 1914 to 25,997,000 tons in 1918. Since then approximately 1000 additional ovens have been built and 370 are in process of construction today.

What 10 Years Have Done for the Coke Industry

COKE PRODUCTION

	By-product		Beehive		Total
Year	Net tons	Ovens	Net tons	Ovens	Net tons
1920	29,000,000*	10,906	21,000,000†	82,000†	50,000,000
1919	25,171,000	10,379	19,650,000	82,961	44,821,000
1918	25,997,530	9,279	30,481,000	86,164	56,000,000
1917	22,439,280	7,298	33,167,548	88,872	55,606,828
1916	19,069,361	7,283	35,464,224	91,581	54,533,585
1915	14,072,895	6,268	27,508,255	93,110	41,581,150
1914	11,219,943	5,809	23,335,971	93,946	34,555,914
1913	12,714,700	5,488	33,584,830	96,962	46,299,530
1912	11,115,164	5,211	32,868,435	97,019	43,983,599
1911	7,847,845	4,624	27,703,644	99,255	35,551,489
1910	7,138,734	4,078	34,570,076	100,362	41,708,810

*Government estimate. †Estimated from government figures.

Night Scene at American Steel Works

Annual Market Reviews For 1920

Pig Iron
Coke
Semifinished Steel
Tin Plate
Cast Iron Pipe
Merchant Bars
Welded Pipe
Wire Products
Plates
Ferroalloys
Structural Shapes
Rails
Sheets
Warehouse Trade
Nonferrous Metals
Old Material
Coal By-Products
Refractories

Prepared by The Iron Trade Review Staff Representatives

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Market Reverses Itself in 1920

Begins Year with Growing Shortage of Material, Rising Prices and Expanding Production; Closes with Widespread Suspensions, Falling Prices and Restrained Buying—Amazing Contrasts Mark Past Twelve Months and Some Continue

A YEAR of amazing contrasts in prices, in demand, in operations and in general policies fully describes the iron and steel market of 1920. Following largely the course traced by all leading lines of manufacturing, the iron and steel industry has passed through a feverish period of excessive demand, inflated values and disordered conditions of trade only to find itself back or below where it started twelve months previously. Not since 1914 has the immediate future stretched so uncertainly. This is no less so because the year ends with the anomaly of one large fraction of the industry operating nearly on a maximum basis and with bookings calculated to sustain this activity for some months while the majority of producers bereft of orders and with outputs severely curtailed, are cutting operating costs and prices looking to a new period of vigorous competition. How this situation may be reconciled holds the key to the general conditions to prevail during the next few months.

Prices of iron and steel in the year described a complete arc. At the beginning of 1921 they were virtually on the same level which had prevailed in the latter part of November, 1919, when the upward movement of the market, that was to continue for many months, was in motion. The market begins the new year therefore on a generally lower basis of $2 to $3 a ton than it did in 1920.

Two Prices Prevail

No feature of the year stands forth so distinctly to mark it as a period of unusual market conditions than the double price standards on steel products especially, which obtained during all but a brief period of the twelve months. In this respect, it is doubtful whether this situation ever has had an exact parallel in past market history, at least not in recent years. The Steel corporation mills adopting on March 21, 1919, in company with all other producers, the reduced schedule of prices recommended by the specially appointed industrial board of the department of commerce, has maintained consistently with some exceptions, this basis of quotations up to the present time. The only departure from this rule was the advance of $5 per ton in wire products put in effect by the American Steel & Wire Co. in August and a similar raise in semifinished forms announced about the same time by the Carnegie Steel Co. On the other hand independent producers, breaking away from the industrial board schedule back in the fall of 1919, formulated their quotations throughout 1920, solely in accordance with the conditions of supply and demand. This policy, varying among individual mills, only in degree, resulted in a rising plane of prices that in a number of finished lines reached the highest point ever known to the industry. At one time the spread between the quotations of the Steel corporation and the independent mills on certain materials, amounted to as much as $40 to $50 a ton. On the average it was $15 to $20 per ton in principal products. Sharpest margins of difference were shown in sheets, sheet bars, steel bars, wire products, and cold-finished bars.

Traffic Is Problem

Obstacles to mill operations such as the railway yardmen's strike and the subsequent shortage of cars which infered so strongly with shipments tended to prolong the premium market. With the Pittsburgh district as the most affected point, there developed a tremendous backing up on plant yards of finished and semifinished material rolled for the customer's account which could not be moved. Then was witnessed on a scale never before duplicated, the pressing into service by consumers, of motor trucks, river barges and every form of emergency conveyance which could supplement the suspended functioning of the steam lines. In July it was estimated that fully 1,000,000 tons of rolled material was on mill yards awaiting to be taken away by consumers. Such an accumulation of marketable tonnage by the mills represented a marked departure from the traditional policy of the industry not to stock production on an extensive scale. This fact tends to illustrate the insistent character of the demand that prevailed and the great absorptive power of the market then in prospect.

Break Is Swift

When it seemed that the industry in part was to suffer virtual strangulation from the freight congestion, the interstate commerce commission heeded the signals of distress from the steel plants and began a series of modifications of the car service regulation which had been imposed in behalf of the coal traffic. These measures helped greatly to restore something like normal shipments and to release the great tonnage of tied-up steel. This flowed forth to consumers and production continued to rise just as the collapse of the automotive industry and a general slowing down of demand in many lines of trade became pronounced. The steel market having reached its crest in August and September, quickly reflected the change in conditions. Prices developed gradual easiness. A wave of cancellations ensued. The action of a leading Pittsburgh independent in-

Prices Present and Past

Representative market figures yesterday, one month ago, three months ago and one year ago

Prices given in this table are those ruling on the largest percentage of sales, at the dates named

	Prices Jan. 5, 1921	Average prices Dec., 1920	Oct., 1920	Jan., 1920
PIG IRON—				
Bessemer, valley, del., Pittsburgh	$ 33.96	$36.96	$50.15	$40.40
Basic, valley, delivered, Pittsburgh	31.96	34.96	47.20	39.20
*No. 2 Foundry, val. del. Pittsburgh	36.96	37.21	48.96	40.90
*No. 2 Foundry, Chicago	35.00	36.50	46.00	40.00
Lake Superior charcoal, Chicago	43.50	50.75	58.50	48.75
Malleable, valley	35.00	35.60	48.25	40.35
Malleable, Chicago	35.50	37.00	46.50	40.50
*Southern, No. 2, Birmingham	38.00	38.00	42.00	38.20
*Southern Ohio, No. 2, Ironton	35.00	37.25	46.00	39.50
Basic eastern del. eastern Pa.	33.50	35.60	51.25	39.75
**No. 2X, Virginia furnace	35.25	39.75	49.75	41.25
**No. 2X, eastern del., Philadelphia	37.00	37.85	52.65	43.90
Gray forge, valley, del., Pittsburgh	35.96	34.25	50.96	39.60
Ferromanganese, 80 per cent, tidewater	110.00	145.00	170.00†	146.00†
SEMIFINISHED MATERIAL—				
Sheet bars, bessemer, Pittsburgh	47.00	47.65	63.75	53.40
Sheet bars, open-hearth, Pittsburgh	47.00	47.65	63.75	53.40
Billets, bessemer, Pittsburgh	43.50	46.25	58.75	49.60
Billets, open-hearth, Pittsburgh	43.50	46.25	58.75	49.60
FINISHED MATERIAL—				
Steel bars, Pittsburgh	2.35	2.35	3.25	3.10
Steel bars, Chicago	2.73	2.73	3.88	2.62

	Prices Jan. 5, 1921	Average prices Dec., 1920	Oct., 1920	Jan., 1920
FINISHED MATERIAL—Continued				
Iron bars, Philadelphia	$ 2.85	$3.90	$4.65	$3.75
Iron bars, Chicago mill	3.35	3.47	3.75	3.13
Beams, Chicago	2.83	2.83	3.33	2.72
Beams, Pittsburgh	2.45	2.45	3.10	2.64
Beams, Philadelphia	2.80	2.80	3.435	2.90
Tank plates, Pittsburgh	2.65	2.65	3.20	3.10
Tank plates, Chicago	3.03	3.03	3.68	2.92
Tank plates, Philadelphia	3.00	3.00	3.485	3.65
Sheets, blk., No. 28, Pittsburgh	4.35	4.45	7.00	5.00
Sheets, blue annld., No. 10 Pittsburgh	3.55	3.65	5.00	4.05
Sheets, galv., No. 28, Pittsburgh	5.70	5.85	7.50	6.35
Wire nails, Pittsburgh	3.25	3.25	4.00	4.25
COKE—				
Connellsville furnace, ovens	5.50	6.25	15.10	6.00
Connellsville foundry, ovens	6.50	7.25	16.85	7.00
OLD MATERIAL—				
Heavy melting steel, Pittsburgh	15.00	16.25	28.00	26.50
Heavy melting steel, eastern Pa.	15.50	16.25	23.55	24.45
Heavy melting steel, Chicago	15.50	16.25	21.35	24.25
No. 1 wrought, eastern Pennsylvania	20.50	20.50	29.85	32.90
No. 1 wrought, Chicago	16.00	16.50	22.50	29.00
Rerolling rails, Chicago	15.50	16.50	34.00	33.60

*1.75 to 2.25 silicon. **2.25 to 2.75 silicon. †Delivered.

terest in November in reducing major lines to the Steel corporation level caused a precipitate decline in all directions. Within two weeks prices had dropped $8 to $15 per ton. By December practically all producers were back to the minimum basis of the year. The wiping away of bookings by cancellations and the absence of new buying produced in October the begining of a sharp curtailment of production. From that time to January approximately 100 blast furnaces were blown out. At the year-end there was a general suspension of operations among independent iron and steel companies to a condition that had not been paralleled since 1914. The Steel corporation having retained, in large part its huge order book, which on Dec. 1 stood at 9,000,000 tons, was able to maintain practically maximum operations.

Roads Fail To Buy

Railroad buying in 1920 while better than for several years past was disappointing. Large equipment orders so confidently expected after the restoration of private control, failed to materialize. The brightest feature was the resumption of rail buying for 1921 delivery on a scale comparable with prewar years. Probably 2,000,000 tons were on rail mill books at the opening of the new year for rolling during the next 12 months.

Foreign trade in iron and steel continued in large volume during the year despite the unfavorable basis of exchange which added a premium to American prices in many countries. For the first 10 months of the year exports reached a grand total of 3,991,367 gross tons, or at a rate somewhat in excess of 1919. Then the total outward movement for the 12 months was 4,400,004 tons as against 5,375,281 tons in 1918; 6,439,067 tons in 1917; and 6,101,134 tons in 1916.

1920 Output Is Good

The 1920 output has been good from a tonnage standpoint, being the fourth largest total in history. It was exceeded by 1916, 1917 and 1918 and showed a substantial gain over 1919. Coke pig iron output in the year was approximately 36,000,000 tons, compared with 30,549,930 tons in 1919. In 1918 it was 38,422,175 tons; in 1917, 37,863,643 tons; and in 1916, 38,844,598 tons. The output of steel ingots was between 40,000,000 and 40,500,000 tons. This compares with 33,694,795 tons in 1919; 43,051,022 tons in 1918; 43,619,200 tons in 1917; and, 41,401,917 tons in 1916. These totals represent very creditable records of output considering the interruptions of operations during the year, first by the railway switchmen's strike, then by the car shortages precipitated by the preferential treatment given to coal transportation, and finally by the slump of the market in the last three months of the year. Shipments of iron ore from the Lake Superior region in 1920 were approximately 60,100,000 tons of which 58,500,000 tons were moved by vessels.

Composite Market Average

Representing the Combined Average Prices Per Ton of Fifteen Leading Iron and Steel Products.

Yesterday, One Week, One Month, Three Months, One Year and Seven Years Ago

January 5, 1921	December 29, 1920	December, 1920	October, 1920	January, 1920	January, 1914
$52.47	$52.83	$53.45	$68.61	$59.40	$23.11

Average Monthly Iron and Steel Prices in 1920

Average Monthly Prices of Leading Materials at Pittsburgh

PIG IRON	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Bessemer	$40.00	$43.15	$43.40	$43.50	$43.90	$44.25	$46.80	$49.50	$50.45	$50.17	$42.33	$36.96
Basic	39.20	43.65	44.40	44.40	44.65	45.15	47.40	49.40	50.45	47.21	39.46	34.96
Foundry No. 2	40.90	42.40	43.40	44.20	45.40	45.40	46.40	49.65	50.96	48.96	42.96	37.21
Malleable	40.33	43.00	43.75	43.00	43.00	43.25	44.80	48.25	50.50	48.25	40.40	36.75
Gray Forge	39.60	41.40	42.40	42.40	42.40	42.90	45.40	47.80	50.95	50.96	42.21	37.21
SEMIFINISHED												
Billets, Bessemer	49.60	61.65	65.00	*68.00	70.00	66.25	65.00	61.25	60.00	58.75	52.50	46.25
Billets, open hearth	49.60	61.65	66.25	70.00	70.00	66.25	65.00	61.25	60.00	58.75	52.50	46.25
Sheet Bars, Bessemer	53.40	65.00	70.00	70.00	75.00	70.00	70.00	70.00	68.50	63.75	56.25	47.65
Sheet Bars, open hearth	53.40	65.00	72.50	78.00	78.75	75.00	75.00	71.25	68.50	63.75	56.25	47.65
Wire Rods	52.00	56.00	62.50	70.00	70.00	70.00	70.00	70.00	70.00	75.00	72.50	57.00
Strip, hot rolled	3.69c	4.82c	5.25c	5.44c	5.50c	5.50c	5.50c	5.50c	5.50c	5.50c	5.00c	3.87c
Strip, cold rolled	5.65c	7.00c	8.82c	8.50c	8.50c	8.50c	8.50c	8.50c	7.37c	8.50c	8.00c	6.87c
COKE												
Furnace, spot	$ 6.00	$ 6.00	$ 6.00	$11.20	$12.00	$14.50	$15.20	$17.75	$16.90	$15.15	$ 8.40	$ 6.25
Foundry, spot	7.00	7.00	7.00	11.60	12.50	15.00	16.10	18.25	17.90	16.85	9.40	7.25
ROLLED PRODUCTS												
Structural shapes, base	2.65c	3.15c	3.25c	3.25c	3.25c	3.25c	3.25c	3.17c	3.10c	3.10c	3.03c	2.45c
Plates, base	3.10c	3.70c	3.75c	3.65c	3.50c	3.50c	3.50c	3.50c	3.50c	3.20c	3.00c	2.65c
Steel Bars, base	3.10c	3.85c	3.85c	3.65c	3.25c	3.25c	3.25c	3.25c	3.25c	3.25c	3.00c	2.35c
Bar Iron, base	3.85c	4.15c	4.50c	4.50c	4.25c	4.00c	4.00c	4.00c	4.60c	4.75c	4.45c	3.75c
Cold Finished Steel Bars	3.65c	3.85c	4.50c	5.25c	4.40c	4.50c	4.10c	4.55c	4.25c	4.10c	4.00c	3.60c
Steel Pipe ¾ to 3 inch, discount	57.50	57.50	57.50	57.50	57.50	57.50	57.50	57.50	57.50	57.50	57.50	57.50
Standard Spikes	3.45c	3.70c	3.95c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	2.75c
Wire Nails, base	4.25c	4.20c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	4.00c	3.25c
Plain Wire, base	3.00c	3.00c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.50c	3.25c	3.25c
Hoops	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
Bands	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c	3.05c
Structural Rivets	4.15c	4.40c	4.50c	4.50c	4.50c	4.50c	4.50c	4.50c	4.60c	4.75c	4.75c	4.50c
No. 28 Black Sheets	5.00c	6.00c	6.00c	6.00c	7.00c	7.00c	7.00c	7.00c	7.00c	7.00c	6.05c	4.45c
No. 28 Galvanized Sheets	6.35c	7.00c	7.25c	7.50c	7.50c	7.50c	7.50c	7.50c	7.50c	7.50c	7.35c	5.85c
No. 10 Blue Annealed Sheets	4.05c	5.50c	5.50c	4.85c	5.00c	5.00c	5.00c	5.00c	5.00c	5.00c	4.95c	3.65c
Tin Plate	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00	$ 7.00
OLD MATERIAL												
Heavy Melting Steel	$26.50	$28.15	$28.00	$26.40	$25.50	$25.30	$25.70	$27.75	$28.60	$28.00	$24.00	$18.75
Low Phosphorus	31.50	33.00	32.60	30.60	30.00	30.75	30.00	33.15	34.00	33.75	31.00	25.50
No. 1 Cast	32.50	41.50	41.00	39.60	39.00	40.00	38.50	41.50	42.20	40.75	38.00	27.50

Average Monthly Prices of Leading Materials at Chicago

PIG IRON	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Lake Superior charcoal	$48.75	$55.65	$57.50	$57.50	$57.50	$57.50	$57.50	$57.50	$58.30	$58.50	$58.50	$53.50
Northern No. 2 Foundry	40.00	42.25	43.00	43.00	43.00	43.00	44.40	46.00	46.00	46.00	42.20	36.50
Southern No. 2 Foundry	42.50	45.00	45.00	45.00	45.50	45.50	47.00	47.00	48.66	48.66	45.66	44.66
Malleable	40.50	42.75	43.50	43.50	43.50	43.50	44.90	46.50	46.50	46.50	43.00	37.00
ROLLED PRODUCTS												
Bar Iron	3.13c	3.44c	3.50c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.75c	3.65c
Steel Bars	2.62c	2.62c	3.03c	3.52c	3.52c	3.52c	3.52c	3.52c	3.93c	3.88c	3.16c	2.73c
Structural Shapes	2.72c	2.72c	3.16c	3.72c	3.72c	3.67c	3.52c	3.52c	3.63c	3.31c	3.08c	2.83c
Plates	2.92c	2.92c	3.38c	4.02c	4.02c	3.95c	3.77c	3.77c	3.88c	3.63c	3.38c	3.03c
Sheets No. 28 Black	4.62c	4.62c	4.62c	4.62c	4.62c	4.62c	4.62c	4.62c	4.71c	4.73c	4.73c	4.73c
OLD MATERIAL												
No. 1 R. R. Wrought	29.00	30.75	30.00	30.70	29.50	28.00	28.10	28.50	27.50	22.50	19.50	17.00
Heavy Melting	24.25	25.05	24.20	23.95	23.15	22.40	23.70	24.15	24.20	21.40	18.50	16.75
Rerolling Rails	33.60	34.65	32.60	32.50	31.50	32.35	34.90	38.00	38.50	34.00	24.15	17.40
Car Wheels	36.25	38.75	36.15	38.50	38.25	36.00	35.70	38.40	38.80	37.25	33.25	26.45
No. 1 Cast Scrap	42.50	43.25	42.20	44.10	42.50	41.75	41.20	42.00	39.30	32.75	27.65	22.10

Average Monthly Prices of Leading Materials in the East

PIG IRON	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Basic, Eastern Pennsylvania	$39.75	$40.50	$43.00	$43.70	$44.00	$44.05	$44.10	$47.45	$51.15	$50.75	$44.55	$34.75
No. 2X foundry, Philadelphia	43.90	45.00	45.68	46.80	46.90	46.90	48.55	50.95	53.75	52.625	46.75	37.60
No. 2X Virginia, furnace	41.25	42.75	43.25	44.25	45.75	46.25	46.75	49.25	50.25	49.75	45.75	40.75
Standard low phosphorus, Philadelphia	51.60	53.55	53.80	53.80	54.80	60.20	57.80	59.60	65.30	65.30	*65.30	*65.30
Standard gray forge, eastern Pa	41.30	41.50	43.15	43.75	44.25	44.25	44.75	47.25	49.10	46.85	44.70	36.50
*Nominal.												
ROLLED PRODUCTS												
Tank plates, base, Philadelphia	3.65c	4.25c	4.25c	4.25c	3.95c	3.775c	3.55c	3.625c	3.55c	3.54c	3.30c	3.00c
Structural shapes, base, Philadelphia	2.90c	3.75c	4.00c	4.25c	3.875c	3.675c	3.50c	3.50c	3.55c	3.425c	3.35c	2.80c
Steel bars, base, Philadelphia	3.00c	3.25c	3.95c	4.00c	4.25c	4.25c	4.25c	4.25c	4.35c	3.85c	3.35c	2.70c
Bar Iron, common base, Philadelphia	3.75c	3.75c	4.20c	4.25c	4.25c	4.30c	4.50c	4.75c	4.85c	4.725c	4.40c	4.05c
No.10 blue annealed sheets, Philadelphia	4.60c	5.05c	5.13c	5.44c	5.56c	5.75c	5.625c	5.875c	6.00c	5.80c	5.35c	3.90c
Open-hearth billets, Philadelphia	$59.10	$59.70	$63.60	$64.10	$64.10	$64.10	$64.10	$61.60	$64.74	$60.74	$55.74	$55.74
OLD MATERIAL—Delivered Eastern Pennsylvania												
No. 1 Heavy melting steel	$24.25	$25.75	$25.55	$24.30	$23.60	$22.40	$22.00	$24.10	$26.40	$23.80	$20.30	$16.90
No. 1 R. R. Wrought	32.90	36.10	36.50	35.25	34.00	33.50	33.50	33.25	34.40	29.85	25.75	20.90
No. 1 Heavy cast	35.80	39.50	40.20	39.00	38.50	38.00	38.00	39.50	50.80	38.75	34.50	28.90

Pig Iron Demand of Extremes

Year Is Started with Feverish Demand and Shortage of Supplies and Closed with Buyers Indifferent and Waiting—Prices Make Steady Advance to High Point in September when Reaction Develops

INTERESTING and varying conditions prevailed in the market for pig iron in 1920. Extreme shortage, rising prices, deferred deliveries, practically no demand, surpluses, resales, and falling levels, in the order named, were the high lights.

To get a clear understanding of the contributing causes, it is necessary to engage briefly in a retrospecting survey of the conditions previous to the opening of the year, with a scarcity of tonnage existing. This recalls the steel strike which took place in September, 1919. Despite its utter failure, it crippled production greatly, the loss being estimated at 2,000,000 tons. While the steel strike still was under way, operations were further restricted and almost demoralized by the coal strike that was begun Nov. 1 of the same year. Both strikes finally were ended about the middle of November but it required considerable time for the trade to recuperate and to re-establish works organizations. The loss of output by the first of 1920 in the face of an improving market and greater demand, was keenly felt.

Buying was light, not because iron was not wanted, but by reason of the small supply that could be obtained. Concern was manifested by melters as to their inability to cover requirements through the first quarter and first half.

Indicative of the response to the shortage is the fact that basic iron advanced from an average of $30, valley, in December, 1919, to $37, valley, the first week in January, and in the East No. 2X foundry iron rose from $36.15 to $43.50. Similar increases were registered in other grades throughout the various districts. A Buffalo producer announced a schedule for the second quarter of $40 for foundry iron but soon increased this to $42. Active demand existed for copper-free low phosphorus iron and a valley maker sold tonnages for first half shipment at $45, furnace, or $46.40, Pittsburgh. One of the largest purchases of basic iron was that made by a large eastern Pennsylvania consumer, who took approximately 50,000 tons, mostly for second quarter delivery, at a little less than $40, delivered, following which prices took another upward trend. Foundry grades were selling in the various sections in good quantities as the result of the activity of the automobile trade and sizable lots of No. 2 (1.75 to 2.25 silicon) were disposed of early in the year at Cleveland to foundries connected with the automobile industry at $42, furnace. Some makers, however, avoided a quotation above $40 and shaded this level.

Toward the latter part of January sales of pig iron for the last half reached a large total, New York reporting 50,000 to 75,000 tons, Buffalo 50,000 tons and Cleveland 50,000 to 75,000 tons. Producers exercised caution in selecting buyers, realizing that there might be considerable speculation in booking so far ahead. Most of the last half business was done at $40, furnace, for No. 2 foundry and $40.50 for malleable. Basic iron for this delivery was sold at $3 higher and export prices were only slightly in excess of domestic quotations.

The last week in January saw heavy selling of iron for last half delivery in all districts, except Pittsburgh, with Cleveland still the most prominent point in the matter of tonnage. The turnover for the week in that territory was esti-

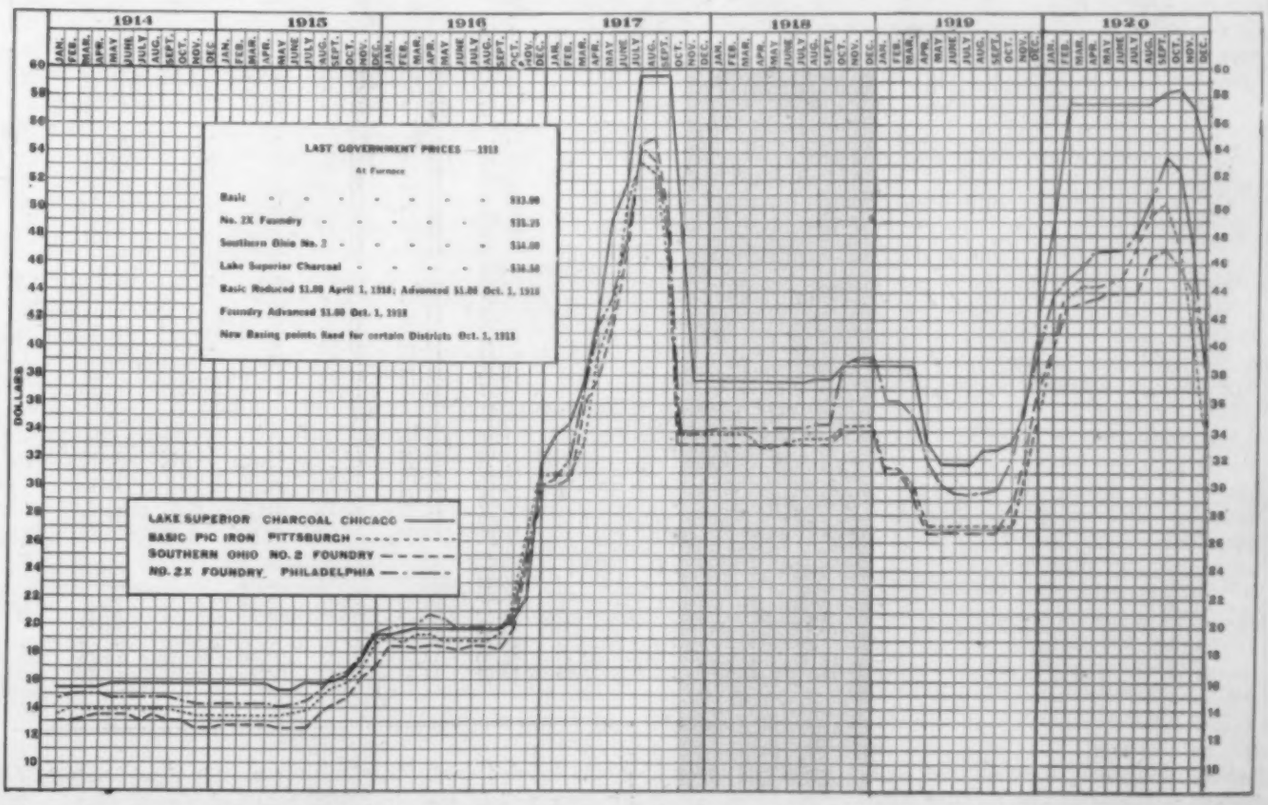

1914
1915
1916
1917
1918
1919
1920
DOLLARS
LAST GOVERNMENT PRICES — 1918
At Furnace
Basic - - - - - - - - $33.00
No. 2X Foundry - - - - - - $33.25
Southern Ohio No. 2 - - - - - - $34.00
Lake Superior Charcoal - - - - - $38.50
Basic Reduced $1.00 April 1, 1918; Advanced $1.00 Oct. 1, 1918
Foundry Advanced $1.00 Oct. 1, 1918
New Basing points fixed for certain Districts Oct. 1, 1918
LAKE SUPERIOR CHARCOAL CHICAGO
BASIC PIG IRON PITTSBURGH
SOUTHERN OHIO NO. 2 FOUNDRY
NO. 2X FOUNDRY PHILADELPHIA

CHART OF AVERAGE MONTHLY PRICES OF FOUR LEADING GRADES OF PIG IRON 1914-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

mated at 175,000 tons, including further tonnages of basic, which went at $40, valley furnace. A Michigan automobile the selling of northern iron in the Chicago and adjoining districts on a Birmingham basis, sales figuring out at prices alone disposing of one-half this quantity. Commitments continued heavy in the first week of February, Buffalo tak-

Prices of Representative Grades of Pig Iron

1914-1920

BASIC, PITTSBURGH

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$39.20	$43.65	$44.40	$44.40	$44.65	$45.15	$47.40	$49.40	$50.45	$47.21	$39.46	$34.96
1919	31.40	31.40	30.35	27.15	27.15	27.15	27.15	27.15	27.15	27.15	30.40	35.40
1918	33.95	33.95	33.95	32.95	32.95	33.20	33.40	33.40	33.40	34.40	34.40	34.40
1917	30.95	30.95	32.85	39.20	42.14	50.20	53.20	52.75	43.95	33.95	33.95	33.95
1916	19.20	18.77	19.20	19.20	18.95	18.95	18.95	18.95	19.08	20.83	25.95	30.95
1915	13.45	13.45	13.45	13.45	13.45	13.54	13.83	14.89	15.65	15.95	16.70	18.55
1914	13.42	14.09	13.96	13.90	13.90	13.90	13.90	13.90	13.90	13.75	13.45	13.45

BESSEMER, PITTSBURGH

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$40.00	$43.15	$43.40	$43.50	$43.90	$44.25	$46.80	$49.50	$50.45	$50.17	$42.33	$36.96
1919	33.60	33.60	32.55	29.35	29.35	29.35	29.35	29.35	29.35	29.35	32.00	36.65
1918	37.25	37.25	37.25	36.15	36.15	36.40	36.60	36.60	36.60	36.60	36.60	36.60
1917	35.95	35.95	37.45	42.20	44.95	55.20	57.95	55.55	48.27	37.25	37.25	37.25
1916	21.32	21.45	21.55	21.95	21.95	21.95	21.95	21.95	22.20	24.33	30.35	35.95
1915	14.70	14.63	14.55	14.55	14.55	14.58	14.88	15.89	16.80	16.95	17.45	19.70
1914	15.00	15.09	15.15	14.90	14.90	14.90	14.90	11.90	14.90	14.85	14.70	14.70

VIRGINIA NO. 2X FURNACE

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$41.25	$42.75	$43.25	$44.25	$45.75	$46.25	$46.75	$49.25	$50.25	$49.75	$45.75	$42.05
1919	35.25	33.00	31.65	28.45	27.50	26.50	26.50	28.25	29.25	30.35	33.40	38.25
1918	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	37.50	38.00	38.00
1917	26.50	28.25	34.25	38.30	41.00	46.50	52.25	51.90	46.50	33.50	33.50	33.50
1916	17.25	18.00	18.25	18.50	18.50	18.50	18.50	18.50	17.50	18.50	23.75	27.00
1915	12.50	12.50	12.50	12.50	12.50	12.50	12.50	13.00	13.50	14.00	15.50	17.00
1914	12.75	12.75	12.75	12.75	12.50	12.50	12.50	12.50	12.50	12.50	12.50	12.50

SOUTHERN OHIO NO. 2 FOUNDRY, IRONTON

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$39.50	$43.00	$43.25	$43.25	$44.00	$44.00	$44.00	$46.50	$46.80	$46.00	$44.00	$39.50
1919	31.00	31.00	29.95	26.75	26.75	26.75	26.75	26.75	26.75	28.80	31.75	36.55
1918	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	33.00	34.00	34.00	34.00
1917	30.00	30.75	35.80	37.75	41.20	47.50	54.50	55.00	49.25	33.00	33.00	33.00
1916	18.30	18.50	18.30	18.50	18.50	18.15	18.44	18.40	18.13	19.38	24.00	30.00
1915	12.75	12.75	12.75	12.75	12.56	12.50	12.60	13.63	14.20	14.88	16.13	17.00
1914	13.00	13.00	13.25	13.50	13.50	13.50	13.00	13.50	13.00	13.00	12.63	12.63

LAKE SUPERIOR CHARCOAL IRON, CHICAGO

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$48.75	$55.65	$57.50	$57.50	$57.50	$57.50	$57.50	$57.50	$58.30	$58.50	$58.50	$53.50
1919	38.70	38.70	33.25	31.75	31.75	31.75	32.75	32.75	33.15	35.50	41.00	
1918	37.50	37.50	37.50	37.50	37.50	37.50	37.70	37.70	37.70	37.70	38.70	38.70
1917	33.75	34.50	37.55	42.25	49.25	51.80	59.50	59.50	59.50	48.50	37.50	37.50
1916	19.25	19.50	19.75	19.75	19.75	19.75	19.75	19.75	19.75	20.35	21.95	31.75
1915	15.75	15.75	15.75	15.75	15.25	15.25	15.75	15.75	15.95	16.25	17.50	19.25
1914	15.50	15.50	15.50	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75	15.75

STANDARD LOW PHOSPHORUS, PHILADELPHIA

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$51.60	$53.55	$53.80	$53.80	$54.80	$60.20	$57.80	$59.60	$65.30	$65.30	*$65.30	*$65.30
1919	51.00	51.00	49.90	46.75	45.80	42.25	41.10	40.25	40.25	40.35	43.00	47.50
1918	55.50	55.50	55.50	55.50	55.50	55.50	56.00	56.00	56.00	57.00	57.00	57.00
1917	54.50	57.50	66.70	75.50	77.00	85.00	92.50	92.50	82.00	55.50	55.50	55.50
1916	54.50	57.50	66.70	75.50	34.00	34.00	33.00	33.00	34.00	40.00	46.00	55.00
1915	19.00	19.00	20.00	20.00	20.00	20.50	21.50	23.50	24.50	28.00	30.00	32.00
1914	21.00	21.00	21.00	21.00	21.00	20.50	20.50	21.00	21.00	21.00	19.00	19.00

BASIC EASTERN PENNSYLVANIA

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$39.75	$40.50	$43.00	$43.70	$44.00	$44.05	$44.10	$47.45	$51.15	$50.75	$44.55	$34.75
1919	33.90	33.90	32.85	29.65	28.80	25.50	26.50	27.00	27.00	27.90	33.00	35.75
1918	33.90	33.90	33.90	32.90	32.90	32.90	32.90	32.90	32.90	36.60	36.90	36.90
1917	30.15	30.50	33.80	38.25	40.80	46.40	50.75	51.00	46.50	33.50	33.50	33.50
1916	19.50	19.50	20.00	20.50	20.00	19.25	19.00	19.25	20.00	21.00	25.50	30.50
1915	13.50	13.75	14.00	13.25	13.50	13.50	13.75	15.25	17.25	17.50	17.75	18.00
1914	14.00	14.25	14.25	14.25	14.00	14.00	14.00	14.00	14.00	14.00	13.50	13.50

NO. 2X FOUNDRY, PHILADELPHIA

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$43.90	$45.00	$45.68	$46.80	$46.90	$46.90	$48.55	$50.95	$53.75	$52.625	$46.75	$38.95
1919	36.15	36.15	35.10	31.90	30.10	29.60	29.50	29.60	29.95	32.00	35.85	40.75
1918	34.25	34.25	34.25	34.25	34.25	34.25	34.50	34.50	34.50	38.85	39.15	39.15
1917	30.50	31.75	36.90	41.75	43.35	47.50	54.35	53.40	47.80	34.00	34.00	34.00
1916	19.75	20.00	20.00	20.75	20.50	19.75	19.75	19.75	19.75	20.50	25.25	30.00
1915	14.25	14.25	14.25	14.25	14.00	14.25	14.50	15.25	16.25	16.50	17.50	19.25
1914	14.75	15.00	15.00	15.00	14.75	14.75	14.75	14.75	14.75	14.50	14.25	14.25

SOUTHERN NO. 2, BIRMINGHAM

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$38.20	$40.00	$40.00	$40.00	$42.00	$42.30	$42.30	$42.00	$42.00	$42.00	$39.50	$38.00
1919	31.00	31.00	30.00	26.75	26.25	25.25	25.00	26.75	26.75	17.45	30.65	35.15
1918	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	35.25	35.25	25.25
1917	23.00	24.50	28.00	35.80	35.75	35.75	46.00	48.00	43.50	33.50	33.50	33.50
1916	14.50	14.65	15.00	15.00	15.00	14.45	14.00	13.60	14.40	51.15	19.60	23.00
1915	9.50	9.50	9.40	9.35	9.75	9.55	9.60	11.00	11.30	11.75	13.15	14.20
1914	10.50	10.50	10.60	10.50	10.50	10.45	10.05	10.00	10.00	10.00	9.90	9.50

NO. 2X FOUNDRY, BUFFALO

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1920	$41.50	$44.60	$45.15	$46.25	$46.25	$46.25	$46.25	$48.75	$51.25	$51.25	$46.00	$48.25
1919	32.25	32.25	31.45	28.00	28.00	28.00	28.00	28.70	28.75	29.90	34.45	39.50
1918	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	33.50	35.25	35.25	35.25
1917	35.00	35.00	38.15	40.00	42.75	49.15	53.50	54.00	49.05	33.50	33.50	33.50
1916	18.50	18.60	18.85	19.15	19.00	18.75	18.75	18.75	18.90	20.70	26.65	33.65
1915	13.15	13.05	12.55	12.75	12.75	12.75	12.80	13.70	15.15	15.80	16.70	18.00
1914	13.00	13.00	13.75	13.90	13.50	13.05	13.05	13.20	13.25	12.60	12.45	13.10

*Nominal.

foundry closed for 20,000 tons of foundry and malleable and another for 10,000 tons. An interesting development was ranging from $45 to $47 a ton delivered.

Bookings in January were well in excess of 1,000,000 tons, Cleveland sellers ing 200,000 tons, Cleveland approximately 150,000 tons and New England 60,000 to 70,000 tons, while those at New York

were the heaviest of any week in local history. A number of producers withdrew from the market with buyers insisting on tonnages. Prices became fairly well stabilized but in some districts they increased, a Buffalo interest booking to the final quarter at $45, for the base grade, an advance of $5.

It was in the middle of February that new bookings became lighter, due to the sold-up condition of the furnaces following the heavy buying movement. Some merchant stacks then found themselves booked substantially well to the end of the year. Basic iron went up $3 a ton to $43, a number of buyers remaining in the market, as producers were behind on first half deliveries. Bessemer iron in less demand, was quoted at $42, valley, being out of line with the basic price, but for a good portion of the year alignments had become so disrupted that small attention was paid to the ordinary differentials. In southern Ohio the market was firm but a policy of quoting conservatively was adopted. Iron sold at $40 to $45, Birmingham, while in St. Louis tonnages were taken freely, particularly by foundry interests. Demand for requirements grew stronger in the Chicago district and the leading producer there quoted No. 2 foundry for the last half at $43. In New England demand also became more urgent because of a desire to cover on spot iron in the absence of deliveries against contracts.

Scotch iron was offered in the middle of February at $45.75 to $46.60, Philadelphia, or practically the same basis as eastern Pennsylvania metal of corresponding quality but no business resulted. A considerable tonnage of Buffalo iron had been sold at $45, base. Southern Ohio makers then were up to that figure.

Steel companies soon after came out with basic iron for forward delivery and this created talk of lower prices, and negotiations actually were closed at Pittsburgh at $41.50, valley. At the same time further lots were sold by merchant makers early in March in northern Ohio at $43, furnace. Talk of recessions in prices was shown in the middle of that month to have been unfounded. It developed merchant stacks had on hand extremely large bookings which, as of March 1, totaled more than 4,775,000 tons. Total sales in February were estimated at 1,000,000 tons, explaining the reduced sales in March.

In April came the railroad strike, with embargoes and traffic tieups, with stagnation of the iron and steel industry. Operations generally were reduced 50 per cent or more. It became extremely difficult to get coal and the situation was complicated by the demand of ore loaders at the upper docks for a wage increase of 40 per cent and triple shift. This and shortage of vessel coal delayed opening of the lake ore movement. By the middle of the month more than 75 blast furnaces were banked and the loss of iron production was placed at 500,000 tons. In New England sales of spot iron went at as high as $60. There followed the next week, acute congestion of traffic at Pittsburgh and distress among users of iron was reflected by an increased demand for prompt deliveries. Large tonnages of iron were being piled. But despite this handicap the iron output of April reached 2,752,314 tons or a reduction of 623,454 from March with its 1-day longer operation. The heaviest loss relatively was in steelworks furnaces as against merchant stacks, this comparison standing at 18 and 9.4 per cent, respectively. The net loss in the number of active stacks at the end of February was 37, the total representing 278 against 315 on the corresponding date in March. This was a material improvement over the early days of the switchmen's strike. One-third of the lake vessels normally engaged in the ore traffic, however, were idle because of lack of fuel.

Steelmaking Grades Show Strength

Conditions continued bad and at the end of May interests took the attitude that it was a matter of selling transportation rather than iron. However, production showed a gradual gain, and ore shipments of 6,400,000 tons in May were better than had been expected. More strength developed in steelmaking grades of iron in the Pittsburgh district in June as the result of renewed buying and basic reached an average of $43.65, bessemer $42.85, No. 2 foundry $44, and malleable $41.85, valley, while sales of low phosphorus were made at $51, valley. Coke shortages, continued traffic delays, banking of furnaces, together with urgent demands, caused prices to be sustained on a rising scale. The highest averages were reached on most grades in September, the general freight increase of 40 per cent the preceding month not affecting requests for deliveries in any way. In that month the bessemer and basic grades at $48.49 and malleable at $48.54, valley, reached their peak averages. In August No. 2 foundry was at an average of $47.69, valley, and reached its highest point of $49 in September. Peculiarly by a slump to $41 in November and an estimated average of $35.50 in December.

The reaction in the market really began to be reflected markedly early in September when shipments started to go forward more actively, cutting down the substantial stocks which furnaces throughout the country has on hand. On Aug. 1 these stocks of pig iron were estimated at 300,000 tons, including 130,000 tons in the South. The August output also, at 3,043,918 tons or 102,314 tons over July, was the largest since March and, while the production of September with one day less was somewhat lower, or 3,124,994 tons, October showed a gain with 3,293,843 tons, the greatest monthly output of the entire year. The last two months saw a sharp decrease, with many furnaces banked owing to a lack of demand. Resale iron began to appear in the middle of September, when the automobile and other industries started to slow up, but this tonnage nevertheless was quickly absorbed and prices were maintained. Shipments then were exceeding production by about 15 per cent and stocks were equivalent to about two weeks' consumption on the average. In basic however, for which the demand had been greatest, there was scarcely one week's consumption supply on hand and bookings of merchant furnaces represented about five months' production. But these were dissolved to a great extent so far as specified shipments were concerned, by subsequent developments. This was shown plainly when at the end of September, despite the fact that certain automotive industries restored suspended contracts, resale lots appeared in greater quantities, prices reflected the first symptoms of reversals and producers showed a willingness to make concessions. Valley foundry iron went down from $50 to $47, and southern iron declined $1 or more, being quoted generally at $42, Birmingham.

The average levels on steelmaking iron in September, according to figures of W. P. Snyder & Co., were $53.21, valley, for bessemer and $49.422 for basic, compared with an average of $56.50 for bessemer and $52.82 for basic in July, 1917, the highest these grades ever attained in the history of the industry. The highest historical point of No. 2 foundry was $73.63, the average for August, 1864.

Prices began to decline more rapidly the last week in October, when, with the sharp slackening of iron and steel and other industries, suspension orders became numerous, and were accepted. Furnace interests generally, however, followed a policy of declining requests for cancellations which were numerous. Resale tonnages continued to grow and a number of steelworks stacks came out with offerings several dollars under the market. Both merchant and steelworks furnaces started to bank and by the first week in December bessemer iron was down to $35, basic to $33 and No. 2 foundry to $36, valley. Other grades showed a similar decline. Later in December valley No. 2 foundry fell to $35. The lower quotations attracted but little or no interest and the year ended listelssly, as compared with the almost feverish demand at its start.

Coke Rise and Fall Spectacular

Prices Reach Highest Level in History in August Only To Fall to Low Ebb in December—Decreased Demand from Furnaces and Foundries Brings Slump—Connellsville Production Greater Than in 1919

EASILY, the outstanding feature of the coke market for 1920 was the extremely high prices. The latter reached points that never before in the history of the industry were approached. On spot sales for standard Connellsville coke, tonnages went at as high as $20, ovens, for 48-hour and $21, ovens, for 72-hour fuel. These peaks were touched in August. That month also registered the highest average prices, with furnace coke at $17.75 and foundry at $18.25. The previous high monthly averages were in July, 1917, with spot furnace at $12.50 and spot foundry at $13.

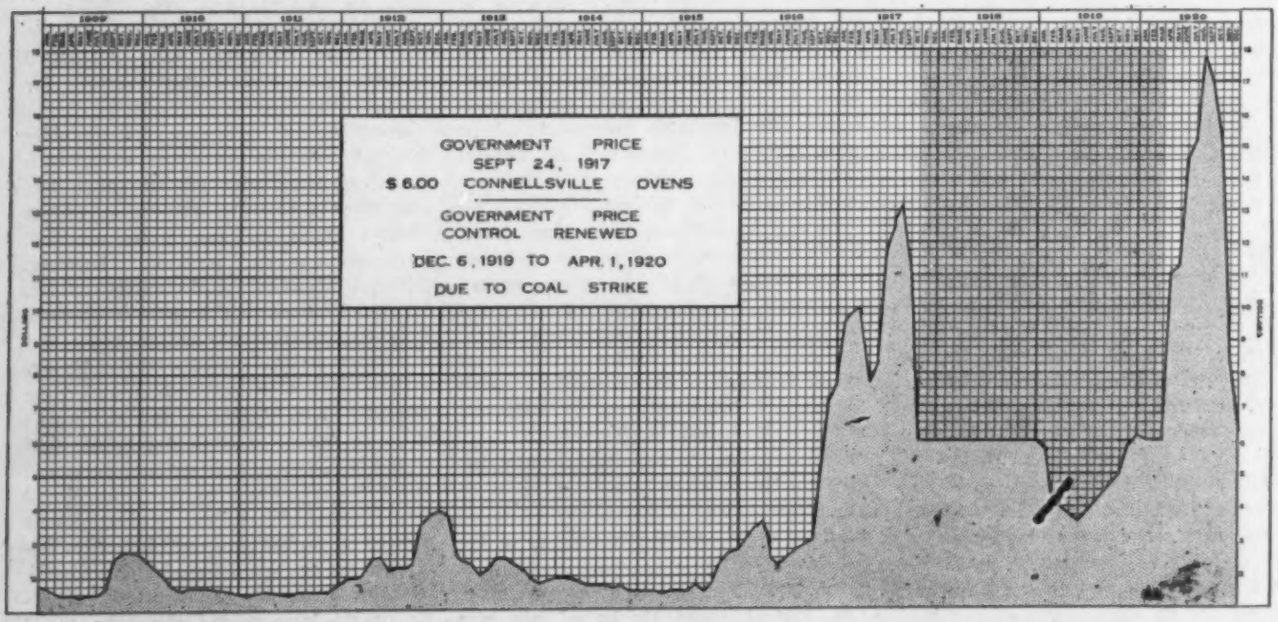
The spectacular rise in prices was challenged in its remarkable upward turn by its sharp break in November when the averages were $8.35 for prompt furnace and $9.35 for prompt foundry coke, declines of $9.35 and $8.85, respectively, under the maximum monthly averages. Early in December prices had dropped to $6 and $7, or less and the estimated monthly averages for that month are $6.50 and $7.50 respectively.

Contract coke for 1921 represents an unusually small quantity due to the exceptional indifference of blast furnace and foundry operators toward negotiating, because of the dullness of their lines of business. Broadly, however, the contract market for the first half of 1921 is $6 to $6.50 on furnace coke with foundry $1 higher. This estimate is based on the fact that most of the limited contracting that was done was on a sliding scale basis of 5 to 1, fixed on the valley price of basic iron. Numerous coke operators were opposed to this form of contract, preferring flat prices but it was a buyer's market from October on, and consumers were able to take their choice. Some, however, had previously closed for first half business at $9 for furnace and $10 for foundry fuel.

The contracting done, however, was so light that the new year enters with a spot market prevailing, such as it is. This form of buying will determine costs, so far as fuel is concerned, for making pig iron and castings.

Consumers Bought Frantically

Explanation of the high coke prices of 1920 lies in the frantic character of the buying by consumers. The latter showed a willingness to pay without hesitation most any figure asked and while they in turn necessarily received high levels for their products, it nevertheless is true that the ratio of their coke costs was higher than in any preceding period. This is shown by the fact that while coke prices of the year were unprecedented, such was not the case regarding pig iron prices. Underlying as the cause of the levels obtained for coke were the elements of demand and transportation, or, rather, the lack of the latter. Had it not been for the fact that by-product capacity is so great, namely practically 60 per cent of the entire coke output of the country, and had steelworks furnaces been made more dependent upon beehive fuel, it is impossible to conceive where prices would have gone or what would have happened in the way of decreased production of pig iron. While by-product construction is making inroads on beehive requirements, the new capacity of the former in 1920 was not great relatively. For instance a total of 540 Koppers ovens went into operation and 310 were under construction at the end of the year, including 60 for Canada. The decrease in by-product coke construction is assigned to the three following factors, in the order of their importance: High cost of financing; high cost of construction and uncertainty of labor and market conditions. Output of Connellsville coke in 1919, at 9,263,652 tons, was less than that of 1920. The latter reached a higher total in the middle of November than the aggregate for 1919. The estimated beehive production of the Connellsville region for 1920 is 11,000,000 tons. A sharp falling off developed early in November and while the pro-



PRICES AT OVENS OF CONNELLSVILLE FURNACE COKE 1909-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

Connellsville, Virginia and West Virginia Coke Prices

AVERAGE MONTHLY PRICES FOR YEAR 1920

	Wise County		Pocahontas		New River		Connellsville	
	Furnace	Foundry	Furnace	Foundry	Furnace	Foundry	Furnace	Foundry
January	$ 7.25	$ 8.25	$ 8.00	$ 8.00	$ 8.00	$ 8.00	$ 6.00	$ 7.00
February	7.25	8.25	8.00	8.00	8.00	8.00	6.00	7.00
March	8.25	9.25	9.00	9.00	8.90	9.00	6.00	7.00
April	11.25	12.25	14.90	14.90	13.75	14.25	11.20	11.60
May	13.00	13.05	12.80	12.80	12.70	13.55	12.00	12.50
June	14.20	14.45	13.75	13.75	14.10	14.20	14.50	15.00
July	18.50	18.75	17.55	18.10	18.00	18.00	15.20	16.10
August	19.70	19.90	20.05	20.15	19.85	20.10	17.75	18.25
September	18.50	19.25	18.50	19.75	18.50	19.25	16.90	17.90
October	17.85	18.60	17.55	18.50	18.05	18.40	15.15	16.85
November	13.20	14.40	12.75	13.75	14.30	15.05	8.40	9.40
December	10.50	12.00	10.55	11.80	12.90	11.15	6.25	7.25

duction fluctuated, the decline was especially noticeable in December when many ovens, in addition to those then idle, were blown out as the result of the break in the market. Some operators would not sell at the prevailing quotations and preferred to put their coal on the market instead. The highest weekly production in the Connellsville region was the week of March 13 to 20, when the output was 249,249 tons.

The demand for coke from the outset of the year in all consuming districts was heavy, and was accompanied by poor traffic service. As a result production was low. Also so much fuel on contract was needed that spot supplies were almost entirely lacking. Car allotments were small and irregular, ranging from 50 down to 10 per cent. Fixed prices of coke, in effect through government fuel regulations until April, when they were withdrawn, meant little or nothing so far as prompt sales were concerned. This was the case because fuel was not available. Coke operators who had not committed themselves for the first half before the imposition of the government prices of $6 for Connellsville furnace and $7 for Connellsville foundry coke, were shipping to regular customers on extensions of old agreements, carrying no price. Later prices were fixed between producers and consumers and made retroactive as of Jan. 1.

Shortage of cars made it necessary to draw coke for furnaces at 72 and 96-hour intervals and there was considerable trading in February of coke for coal, coal for coke and coke for pig iron. Steel companies were said to have been able to buy coke at $6, ovens, by agreeing to allow coke producers to obtain tonnages of pig iron at prices permitting the latter to make $5 a ton profit so that in reality the net price of coke, instead of being $6, was $8 a ton. Some consignees in West Virginia refused to pay invoices on contract shipments carrying more than the government price, which for that grade was $8. This opened the question as to whether those who contracted for Connellsville coke prior to Dec. 6, 1919 when federal control was resumed, were liable for more than $6 for furnace and $7 for foundry on contracts carrying higher figures. The position of West Virginia consignees was upheld by legal authorities of the fuel administration who stated that while certain regulations, etc., of the fuel administration were suspended by an order of Jan. 31, 1919, the administration did not go out of existence prior to that date and this did not permit of contracts above $6 and $7. But the issue never went before a judicial tribunal and operators generally invoiced shipments on contracts rather than on the government basis.

In the East coke sold early in the year at $12.80 to $14, delivered, for Connellsville furnace and foundry coke and by-product foundry coke for the first half at $10, ovens, plus a freight of approximately $5. For the last half, by-product coke makers in the East opened their books at $12 to $16.40, delivered.

With an increase in car supplies late in March there was a turn from a scarcity of coke in the Connellsville region and some producers began to seek buyers. Withdrawal of fuel regulations stimulated the markets and prices of $10 to $12 for either grade of Connellsville coke prevailed during April with like increases at other points of the country on the other grades. Last half coke was sold at $10 flat and on a sliding scale of 4½ to 1, equivalent then to $10. There was some banking of furnaces at this time on account of lack of fuel. In May trainloads of coke were shipped out of the Connellsville region and premiums were paid for small tonnages.

Prices kept mounting, without a break, with irregular car supplies. Part of the latter trouble was due to switchmen's strike, which began in April, although this was not the sole cause of lack of transportation. The latter did not become adequate until in October. By early September it had, however, improved to such an extent that this factor, together with the dullness of the market, started prices to decline and late in October they were down to $16, falling from $1 to $1.50 the third week of that month. Last and first quarter contracting was done at this time on a small scale on a basis of 4 to 1 for Connellsville coke, while in the New York and New England districts considerable first half business was booked. Sliding scale contracts of one eastern interest carried a maximum and minimum clause under which coke delivered in the oven district would not exceed $27.70 nor be less than $23.70. This is said to have been the first time that New England consumers contracted for first half coke, knowing the minimum price throughout the entire six months would be $23.70, delivered. At St. Louis offerings for first half shipment at $15 were numerous. At Birmingham production began to recover as the strike of coal miners waned, and by-product furnace coke sold at $10 to $11 and foundry at $12.50 to $15.

With the pig iron market becoming stagnant the last week in October there was a sensational drop of $5 in spot Connellsville furnace coke to $11 and $12. Contracting in the East for first half business continued at practically the same figures as those prevailing the previous week.

After the marked decline late in October, prices continued their downward trend, with drops of 50 cents to $1.50 practically each week, for Connellsville coke, and this soon was reflected in all markets. Fuel became much easier to get, was in small or no demand and operators began to blow out ovens. But the loss of coke output failed to keep pace with the decrease in consumption as the result of the banking of furnaces.

The market had hit the inevitable slump, which many had foreseen, and consumers not only showed an indifference toward buying spot fuel and contracting but began to order suspension. This condition, alone with resales, brought the market to dull condition at the close of the year.

Semifinished Covers Wide Range

Decline from High Point of Year Is $31.75 in Sheet Bars and $23 in Billets—Automobile Interests Bid Up Market—Prospects Believed To Indicate Healthier Conditions in 1921

RUNNING a feverish course, characterized by insistent demand and rising prices, then lessened inquiry and softer levels, only to be followed by renewed activity and finally reduced to a sagging condition, the market for semifinished steel products in 1920 settled at the close of the year to its minimum, or on the Steel corporation basis. Even lower prices are said to be prevailing on certain forms with some independents.

A representative reflection of the market at present is afforded by the Steel corporation quotations, Pittsburgh basis, of $43.50 on soft 4 x 4 rerolling billets; $47 for soft 2 x 2 rerolling illets and sheet bars; $46 for slabs and 57 for soft wire rods; 2.45c for grooved, 2.55c for universal and 2.65c for sheared skelp, although some independents quote a flat price of 3.00c on each grade. Forging billets are quoted at $51 to $56. The former is said to be the Carnegie steel price The prices of billets, sheet bars, slabs and wire rods are $5 a ton higher than those named by the industrial board and this came about through readjustments made in the latter half of the year by the Carnegie Steel Co. and the American Steel & Wire Co. Sheet bars reached their highest monthly price average in May at $78.75 for open hearth and $75 for bessemer; while open-hearth billets attained their average maximum of $70 in April. The last figure also was the peak for bessemer billets but it was not reached until May.

The drop from the highest monthly averages to the prices current as the new year comes in, therefore, is $31.75 in open-hearth and $28 in bessemer sheet bars, and $23 in billets. Declines in other semifinished lines were on a similar basis. Yet, precipitate as these declines were. they do not adequately tell the story, for demand had become so urgent at one period, notably in March, that prices as high as $90 were done on sheet bars and high carbon forging billets, and even $92 was paid on conversion business by automobile makers. It was the last class of buyers which sent quotations soaring as prices appeared to be almost of no consideration to them. The consumers were ready practically to pay any figure to get the tonnage, something that was extremely difficult to do at times owing to conditions brought about by strikes, fuel shortages and demoralized traffic. The semifinished prices of 1920 were exceeded only once before in the history of the industry and that was in 1917, the period of tremendous war demands. In July of that year the highest averages showed sheet bars at $105 and soft wire rods at $95.

The semifinished market in 1920 was somewhat slower than were finished lines in becoming aligned with the readjusted conditions. But, strangely enough, it developed weakness first, for breaks in prices took place in the third week of September, when open-hearth sheet bars dropped $2.50 a ton from $70, while finished lines held firmly till the first week of November. Reductions of prices on finished products by independents to Steel corporation levels the last week of November necessarily affected semifinished lines and one round lot of open-hearth bars was sold at $47, Pittsburgh, by a mill which had always previously been a buyer of sheet bars. This, however, was an unusual transaction and not truly representative of the market for the seller had just started part of its new open-hearth capacity and had no need for sheet bars at that time.

Sheet bars were sold at $55 at the opening of 1920 and were taken at that figure by sheet users in order to be protected on requirements for finished products. Billets were sold at $50 and soft wire rods at $60 to $65 for domestic consumption and $70 for export. Scarcity of semifinished lines prevailed and resulted in suspension of considerable capacity in both semifinished and finished lines, the shortage of cars and fuel being acute. Mills were forced to decline a great amount of tonnage, including sheet bars, billets, wire rods, and slabs, but chiefly sheet bars.

By the first of March sales of thousands of tons of sheet bars had been made at $90, Pittsburgh, followed by others at $84, the decline being due to

Average Monthly Prices of Semifinished Steel 1916-1920

Per gross ton, Pittsburgh

	January	February	March	April	May	June	July	August	September	October	November	December
BESSEMER BILLETS												
1916	$33.75	$34.00	$40.60	$45.00	$44.25	$41.20	$40.00	$43.60	$45.00	$45.75	$52.00	$58.75
1917	60.00	62.50	67.00	72.50	85.00	93.75	100.00	93.00	73.75	58.75	47.50	47.50
1918	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50
1919	43.50	43.50	42.25	38.50	38.50	38.00	37.30	38.00	38.50	39.30	40.85	45.00
1920	49.60	61.25	65.00	68.00	70.00	66.25	65.00	61.25	60.00	58.75	52.50	46.25
OPEN-HEARTH BILLETS												
1916	34.75	35.00	40.60	45.00	44.25	41.20	40.00	43.60	45.00	45.75	52.00	58.75
1917	60.00	62.50	67.00	72.50	85.00	93.75	100.00	93.00	73.75	58.75	47.50	47.50
1918	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50	47.50
1919	43.50	43.50	42.25	38.50	38.50	38.00	37.30	38.00	38.50	39.30	40.85	45.00
1920	49.60	61.25	66.25	70.00	70.00	66.25	65.00	61.25	60.00	58.75	52.50	46.25
BESSEMER SHEET BARS												
1916	33.75	34.00	41.00	45.00	44.25	41.20	40.00	43.60	45.00	45.75	52.00	58.75
1917	60.00	62.50	67.00	72.50	88.00	101.25	105.00	96.00	82.50	65.50	51.00	51.00
1918	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00
1919	47.00	47.00	45.75	42.00	42.00	41.50	40.80	42.00	42.00	43.20	45.00	48.00
1920	53.40	65.00	70.00	70.00	75.00	70.00	70.00	70.00	68.50	63.75	56.25	47.65
OPEN-HEARTH SHEET BARS												
1916	34.75	35.00	41.00	45.00	44.25	41.20	40.00	43.60	45.00	45.75	52.00	58.75
1917	60.00	62.50	67.00	72.50	88.00	101.25	105.00	96.00	82.50	65.50	51.00	51.00
1918	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00	51.00
1919	47.00	47.00	45.75	42.00	42.00	41.50	40.80	42.00	42.00	43.20	45.00	48.00
1920	53.40	65.00	72.50	78.00	78.75	75.00	75.00	71.25	68.50	63.75	56.25	47.65

the irregularity of the market and not to any weakness. Soft rerolling billets were sold at $65 to $70; high carbon forging billets for second quarter delivery at $90, and soft wire rods at $65 to $70. About the middle of that month signs developed that, whereas previously, prices seemed to be of no moment to automobile makers who bought conversion tonnage for their sheet requirements, the peak had been reached. Consumers of sheet bars in the Mahoning valley, northern Ohio, and surrounding territory invoiced for April delivery on a basis of $80, Youngstown, for open-hearth steel, and $80 for small open-hearth billets and $70 for open-hearth slabs.

The effect of the switchmen's strike on production and shipments was severe in all districts, and during the latter part of April no semifinished steel was being rolled by valley mills, all of them being idle on account of the strike tying up coal shipments.

A marked decline in demand for various lines of semifinished steel was observed early in June, and 4 x 4 rerolling billets were quoted at $60 to $65 and open-hearth and bessemer sheet bars at $70 and $65, respectively. This sag was of short duration for in the middle of that month, open-hearth sheet bars advanced to $75, bessemer sheet bars to $70 and billets to $65. Further increases of $5 were made on tonnages for prompt shipment early in July, when there again developed a heavy export demand which called for prices $5 to $10 a ton over the domestic market.

The point had been reached about the middle of July where consumers were more anxious to get deliveries than to secure a place on mill books for additional tonnages. The ensuing month saw easier quotations, both open-hearth and bessemer sheet bars going at $70 a ton.

The market early in November slumped further, with consumers indifferent, and it was largely because of this condition that producers did not make any vigorous effort to take business. Until the latter came down to the Steel corporation prices. their quotations were largely nominal. Upon reaching the Steel corporation prices early in December, they found that the market failed to respond to any perceptible degree. This action, however, did have the effect of stimulating some buying by sheet and tin plate producers as a result of which these mills made their prices for first half business. Yet other mills had done this previously in anticipation of the reductions in the semifinished lines. Unfilled contracts for the latter were invoiced by most, though not all makers, at the reduced quotations.

Special Car Service Relieves Tin Plate

DESPITE the serious handicaps it had to combat as the result of strikes and railroad congestion which were responsible for intermittent shutdowns of plants and the piling of large stocks, the tin plate industry in 1920 produced an estimated total output of 34,000,000 base boxes as compared with the theoretical capacity of 42,000,000 base boxes. Preferential treatment in car movements granted to the industry through the interstate commerce commission was a great aid in bringing about the rather satisfactory output both in the way of sheet bar supplies and in making deliveries of the finished material. This was made necessary by the famine conditions which prevailed in the market from the outset so far as requirements of the canning industry were concerned the influence of which with regard to prices was quickly reflected, although the American Sheet & Tin Plate Co. retained its level of $7 a base box, which was established by the industrial board on March 21, 1919. This price was reaffirmed by the company for the first half of 1921, as announced when books were opened Dec. 2. Independent mills soon after returned to the quotation for the delivery mentioned.

By the middle of January of last year certain independent producers had made sales at high as $10 but they adhered generally to the $7 price. This however largely was a nominal figure because makers then had been committed up to the first half at that level. Export tonnages were moving at $9 to $9.50. The car shortage began immediately to interfere greatly with deliveries and the situation became tighter. The American Sheet & Tin Plate Co. even before it opened its books for the first half of 1921 could not take on tonnages for shipment before the second quarter. When it had opened its books in December it was well committed up to the second quarter of 1921.

Toward the latter part of January, 1920, exhaustion of storage space had resulted in cutting down operations and stock plate disappeared almost as fast as it accumulated. In the first week of February the leading interest began operations with less than 60 per cent of its plants rolling because of the shortage of sheet bars and cars. In the latter part of February independent makers had unfilled tonnages aggregating 11,000,000 boxes and the American Sheet & Tin Plate Co. had only a slightly smaller amount. This showed the industry to be oversold for the following six months. At this time the leading interest had approximately 50,000 tons of finished material piled awaiting shipment, with the car supply down to 18 to 30 per cent.

It was in the middle of March that independent mills began to take last half business. Some of the business was subject to the price prevailing at time of shipment, while other bookings were reported to have been taken at $8.50, Pittsburgh. Operations had shown an improvement and were proceeding at a fair rate but large stocks were on hand. The McKeesport Tin Plate Co., McKeesport, Pa., had 375,000 boxes waiting for cars, the American Sheet & Tin Plate Co. warehouses were practically full, and other producers were in about the same position. By the use of refrigerator and stock cars, warehouse supplies at plants of the American Sheet & Tin

Average Prices of Tin Plate per Base Box 1916-1920

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1916	$3.75	$3.75	$4.15	$4.70	$5.15	$5.55	$5.80	$6.00	$5.60	$5.75	$6.05	$6.50
1917	6.875	7.00	7.50	7.50	7.90	9.25	10.00	10.00	10.00	10.00	8.20	7.75
1918	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
1919	7.35	7.35	7.25	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00
1920	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00	7.00

Plate Co. in the west were reduced late in March but the decrease was comparatively small in view of the fact that the company had 750,000 boxes still awaiting shipment. At this period the minimum export quotation was $11.

This improvement was only temporary, having been halted by the strike of railroad switchmen which sharply curtailed operations and shut off supplies of fuel and steel. The estimated output then was about 35 per cent. With some variations this situation continued until the middle of May when the position of canners of perishable foods became extremely serious. At the end of this month there were more mills in operation than at any time since the rail tieup and shipments were slightly better, but 2,500,000 base boxes still were piled in warehouses of the country. The position of canners of perishable foods had become so serious that a conference was held in Washington by canners, tin plate makers and government authorities. This resulted in a petition to the interstate commerce commission requesting relief through the immediate placing of cars for the shipment of accumulated tin plate to canners, of fuel to tin plate makers and to steelworks in order to increase sheet bar production. The canners showed that they had only 30 per cent of their normal supply of containers.

The petitioned-for action having been taken by the commission, increased operations were brought about. The period of preferential tin plate shipments was extended throughout June and at the end of this month stocks had been reduced from 2,500,000 to 1,500,000 base boxes. Hope then was entertained, and it proved to be justified, that the better movement would insure deliveries to can makers in ample time for seasonable food packs. Early in June the car preference order was passed on to can makers to follow up tin plate material so as to expedite the arrival of shipments in the form of containers at canneries. Early in July stocks had been so greatly reduced because of the preferential order and the general betterment of conditions that the situation had been restored almost to normal with shipments equaling the output of 75 per cent of capacity. Difficulty still was experienced by shortage of sheet bars, lack of cars and embargoes for some time afterward and the leading interest still continues short of steel. Improvement of operations was gradual and at the end of the year, production was at the rate of about 80 per cent of capacity. Requests for deliveries against contracts were being received but there was a substantial falling off in demand. Stock items were being sold during the last quarter by independents at $7 when in car lots.

New mills for rolling black plate for tinning purposes, which were placed in operation last year, numbered 29. The American Sheet & Tin Plate Co. installed 12, the Bethlehem Steel Co., 12; the Eastern Rolling Mill Co., 4; and the Standard Tin Plate Co., 1.

Cast Pipe Demand Low; Prices Hold

SOMEWHAT conflicting tendencies were manifest in the market for cast-iron pipe in 1920, and buying was light. At the same time prices advanced through much of the year holding most of this rise to the last. Throughout the year inquiry was slow, cities finding it difficult to market securities to provide for extensions and improvements. The high cost of pipe required a large outlay to cover moderate tonnages. As a result of this situation much deferred work did not come out and the cities continued their policy of laying only such pipe as was absolutely necessary. Two factors tended to make the price of cast higher than ever. One was the high level maintained by pig iron through practically the entire year and the second was the increase in freight rates which added to the delivered price. In addition to these factors, pipe makers increased the differential between 4 and 6-inch pipe from $3 to $5 per ton, adding $2 to the price of the smaller sizes. As a result of these additions and several increases in the base price, 6-inch class B pipe advanced from $60, Birmingham, in January to $74 in December, an increase of about 25 per cent. A feature of the year has been the increased number of bid rejections. In the final month a reduction in quotations of nearly $20 per ton was made, bringing the base price at Birmingham to $55. This change discounted expected declines in pig iron.

After the middle of the year cities ceased buying except in small lots and private demand made up most of the business. Some cities inquired for prices, but rejected most offers. Demand for the smaller sizes was greater than for larger pipe, and consequently shop schedules were unbalanced much of the time. While makers held to their quotations for the most part, it became apparent toward the end of the year that concessions on large pipe were necessary. Buyers were offered prices under schedule or were asked to specify a tonnage of large pipe with each purchase of the smaller sizes. In spite of these difficulties the shops at midyear were producing at capacity though they were handicapped by inability to ship because of the railroad situation.

The final portion of the year saw comparatively little business placed. The shops worked toward the end of their order books and had little tonnage left at the close. Indications were that with the expected decline of pig iron after the turn of the year pipe prices would be marked down and buying would come out in better volume, as all indications point to a large repressed demand.

The average monthly prices per net ton of 6-inch class B cast-iron pipe at the three principal market centers, New York, Chicago and Birmingham, in the years 1916 to 1920 inclusive are shown in the accompanying tables.

NEW YORK

	1916	1917	1918	1919	1920
January	$29.00	$41.50	$55.35	$66.20	$67.30
February	29.35	41.50	55.35	62.70	70.30
March	29.50	41.90	55.35	61.65	71.30
April	30.50	51.25	55.35	57.70	73.30
May	30.50	55.50	56.55	56.70	76.30
June	30.50	60.75	61.35	52.70	76.30
July	30.50	65.50	62.25	52.70	76.30
August	30.50	65.50	62.50	53.10	76.30
September	30.50	65.50	62.70	54.30	77.22
October	31.50	55.75	67.70	56.70	77.22
November	34.50	56.10	67.70	58.30	77.22
December	41.00	54.70	67.70	61.30	72.22

CHICAGO

	1916	1917	1918	1919	1920
January	$29.01	$41.00	$54.30	$64.30	$67.55
February	29.50	41.50	54.30	61.80	71.30
March	29.50	43.70	54.30	60.55	72.80
April	30.50	53.00	54.30	56.80	74.40
May	30.50	55.50	55.50	54.80	76.80
June	30.50	60.75	60.75	51.80	76.80
July	30.50	65.50	62.05	52.60	76.80
August	30.50	65.50	61.85	54.80	76.80
September	31.00	65.35	61.80	55.80	81.50
October	31.50	57.75	66.80	59.80	83.10
November	35.00	53.10	66.80	59.80	83.10
December	38.00	54.25	66.80	63.80	75.10

BIRMINGHAM

	1916	1917	1918	1919	1920
January	$24.00	$36.00	$49.00	$58.75	$60.00
February	24.50	36.00	49.00	55.00	64.50
March	25.00	37.40	49.00	54.50	66.00
April	25.00	42.35	49.00	53.00	67.00
May	25.00	47.20	50.20	52.00	70.00
June	25.00	55.00	55.00	48.00	70.00
July	25.00	55.00	55.00	48.00	70.00
August	25.00	55.00	55.00	48.00	70.00
September	25.00	55.75	55.00	48.00	72.40
October	25.50	47.25	60.00	56.00	74.00
November	28.70	45.00	60.00	53.60	74.00
December	35.00	46.00	60.00	58.75	66.40

Demand Exceeds Bar Production

Heavy Early Bookings Limited Sales up to the Last Quarter while High Prices Were Obtainable Until That Period—Much Mill Output Was Lost Due to Car and Fuel Shortages

SOFT-steel bars ran a full course of market conditions in 1920. The year opened after a period of trying conditions which had prevented production, while demand had been maintained. As a result bookings were heavy and producers had large tonnages under contract. Therefore it was necessary to limit further selling and almost to the end of the year this condition was a factor. Only the general business recession and decline of premium prices in the final quarter made free buying possible, which consumers did not desire under the circumstances ruling at the year's end.

Though the minimum price of 2.35c, Pittsburgh, has been maintained by most mills through much of 1919, some advancing their quotations several dollars shortly before the end of that year, the Steel corporation was the only seller holding at that level throughout 1920. Other bar producers quoted far above this figure through practically eleven months. Late November brought the announcement of a return to this price by practically all independent mills, which leveled off the market after a year of double quotations.

Bars were in greater demand than other finished steel products throughout the year. Even after production had started to overtake bookings on plates and shapes, mills were unable to book bars for deliveries during the current year. Only after the depression in automotive building had caused large cancellations and deferred shipments, were producers able to catch up and attain a position where further bookings could be accepted with reasonable assurance of delivery.

Bar Iron Settlements

BIMONTHLY WAGE SETTLEMENTS SHOWING AVERAGE PRICES

	1916	1917	1918	1919	1920
Jan.-Feb.	1.40c	2.35c	3.10c	3.10c	2.55c
Mch.-Apr.	1.60c	2.45c	3.30c	2.75c	2.70c
May-June	1.85c	2.65c	3.35c	2.50c	3.00c
July-Aug.	1.95c	2.75c	3.40c	2.50c	3.25c
Sept.-Oct.	2.00c	2.85c	3.45c	2.50c	3.40c
Nov.-Dec.	2.15c	2.95c	3.45c	2.50c	3.55c

ANNUAL AVERAGE OF SETTLEMENTS

1920	3.07c
1919	2.64c
1918	3.32c
1917	2.67c
1916	1.825c
1915	1.137c
1914	1.1843c
1913	1.4421c
1912	1.2645c
1911	1.2598c
1910	1.4423c
1909	1.360c
1908	1.386c
1907	1.627c

At the time the leading interest was quoting 2.35c, Pittsburgh, some independent mills were able to obtain as high as 4.75c, Pittsburgh, though this was extreme. However, 4.00c, Pittsburgh, was quoted and applied on sales of large tonnage throughout a large part of the year. It was a common quotation for several producers.

Had there been no obstacle to regular production at normal capacity through the year, it is probable mills would have been able to catch up with demand before the slump came. But with order books loaded at the opening of the year, demand heavy and fuel and car shortages limiting production and shipment, headway against the tremendous backlog was slow. In fact, shortage of fuel held down production practically all year. The leading interest was unable to attain a higher rate of operation than 80 per cent at any time, because of lack of sufficient fuel. In addition to this handicap, severe shortage of cars during midyear caused much curtailment of production because of the inability to ship completed orders. Contrary to usual custom, large tonnages were rolled and piled until cars should become available. This policy was carried in some cases to the point that all available storage space was filled and it was necessary to shut down until room could be made for subsequent production.

At the beginning of the year, the United States Steel Corp. subsidiaries were quoting 2.35c, Pittsburgh, and some independents were asking and obtaining 3.50c, Pittsburgh. This was a wide range but the later months broadened it considerably. Mills then were overloaded and those who had made contracts with consumers were unable to take on more business. Even independent producers, whose policy was to take nothing for remote delivery, had all the tonnage they were willing to book and much inquiry was backed up without possibility of being placed. In fact within 30 days after the year opened practically all mills were sold through the first half and into the third quarter.

The outlaw strike of railroad switchmen appeared in the second quarter to further demoralize the situation and this cut down shipments greatly. In April two large agricultural implement makers placed their last half requirements at 3.00c, Pittsburgh, which was considerably under the ruling independent level.

First signs of the automobile slump

Average Steel Bar Prices, by Months, 1907-1920

Prices per pound, base, Pittsburgh

	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
January	1.60	1.60	1.40	1.40	1.40	1.15	1.40	1.20	1.10	1.88	2.93	3.90	2.70	3.10
February	1.60	1.60	1.30	1.45	1.40	1.13	1.41	1.22	1.10	2.01	3.00	2.90	2.70	3.85
March	1.60	1.60	1.20	1.45	1.40	1.11	1.40	1.23	1.15	2.34	3.20	2.90	2.60	3.85
April	1.60	1.60	1.15	1.45	1.40	1.17	1.40	1.17	1.20	2.50	3.40	2.90	2.35	3.65
May	1.60	1.60	1.20	1.45	1.40	1.20	1.40	1.17	1.20	2.50	3.50	2.90	2.35	3.25
June	1.60	1.50	1 20	1.45	1.35	1.21	1.40	1.13	1.20	2 50	3.65	2.90	2.35	3.25
July	1.60	1.40	1.25	1.45	1.24	1.25	1.40	1.12	1.20	2.50	3.90	2.90	2.35	3.25
August	1.60	1.40	1.35	1.40	1.20	1.25	1.40	1.17	1.30	2.50	4.00	2.90	2.35	3.25
September	1.60	1.40	1.40	1.40	1.17	1.34	1.40	1.19	1.34	2.60	3.75	2.90	2.35	3.25
October	1.60	1.40	1.40	1.40	1.11	1.40	1.40	1.18	1.41	2.60	2.90	2.90	2.35	3.25
November	1.60	1.40	1.45	1.40	1.08	1.40	1.34	1.19	1.95	2.78	2.90	2.90	2.45	3.00
December	1.60	1.40	1.50	1.40	1.12	1.40	1.22	1.07	1.74	2.90	2.90	2.90	2.50	2.35

appeared in July, though its scope was not apparent for some weeks.

The market began to turn from a sellers' to a buyers' in the third quarter. Cancellations appeared in September and large sections became easier, though small bars resisted the lowering tendency much longer. General waiting on the part of consumers stopped all buying and by the beginning of the fourth quarter premium prices crumbled rapidly, 3.00c, Pittsburgh, being about the top.

Late in November, following an announcement that the United States Steel Corp. would not advance its quotations, independent mills came down to the prices long maintained by that interest.

Producers of bar iron had a good year on the whole. The market started at 3.00c, Chicago, and reached about 4.00c in the first 60 days. A sale, probably representing close to the top, was made in February at 4.50c, Chicago mill. Heavier demand for small sections caused a dividend quotation of 3.75c to 4.00c. Eastern mills had so much inquiry that quotations there were 4.50c to 5.00c, Pittsburgh, in July. In October business became dull. At the close of the year quotations were nominal, demand was absent and many mills were closed.

With an average price of 3.86c, base, Pittsburgh, for hoops and bands, and 4.24c, base, Pittsburgh, for cold-finished steel bars, the year 1920 saw the market for these products fluctuate widely. The lowest monthly average price for hoops and bands was 3.05c, at which the year both opened and closed, and the highest average was in September at 5.50c. The lowest monthly average price for cold-finished steel bars was December at 3.60c, as compared with the January average of 3.65c, while the highest average was in August at 4.55c.

These products were in strong demand until the break came in the automobile trade in September and consumers were constantly pressing for deliveries up to that period. The last week of November independents reduced their price of cold-finished steel bars to 3.60c, as compared with the American Steel & Wire Co. price of 4.00c, or $8 a ton less, the only commodity in the entire iron and steel list on which independents quoted under the United States Steel Corp. On Nov. 30 the American Steel & Wire Co. reduced its price to 3.60c.

Bar Iron Prices, Chicago, 1916-1920

Base price in cents per pound

	1916	1917	1918	1919	1920
January	1.83	3.00	3.50	3.13	3.13
February	1.91	3.00	3.50	2.95	3.44
March	2.19	3.00	3.50	2.86	3.50
April	2.35	3.19	3.50	2.58	3.75
May	2.35	3.39	3.50	2.50	3.75
June	2.35	4.00	3.50	2.53	3.75
July	2.35	4.50	3.50	2.62	3.75
August	2.35	4.50	3.50	2.62	3.75
September	2.35	4.50	3.50	2.62	3.75
October	2.35	4.50	3.50	2.68	3.75
November	2.52	4.10	3.50	2.73	3.75
December	2.60	4.10	3.50	2.77	3.75

Welded Pipe Is in Demand All Year

ENORMOUS demand for welded pipe of all kinds, particularly oil country goods, existed throughout 1920 and still obtains to a considerable extent. Manufacturers still find themselves greatly deferred in deliveries and have been compelled to decline a vast volume of business. It is a safe assertion that stocks in the hands of several makers for the greater part of the latter half of the year just ended were larger than ever before while those of many jobbers were almost depleted. This situation was due to the bad traffic movement, causing a heavy loss of production. Tonnages were piled from time to time during the year to such a degree that there was no space left in mill yards and it became necessary to shut off production. Conditions were not greatly relieved until toward the end of the year or the middle of November, when the interstate commerce commission issued its order releasing all open top coal equipment to general shipping. Of such importance was this order that the market for the first time became easier.

The National Tube Co. maintained all year and still maintains its March 21, 1919, card, which carries a discount of 57½ per cent off on ¼ to 3-inch black buttweld steel pipe. Cards of independent mills varied, ranging from $7 to $20 a ton over the prices of the leading maker. That they were able to retain the higher level in itself denotes the strength of the market during the year for iron and steel welded pipe which was the only one of the entire iron and steel list that suffered no actual break.

In January five steel pipe makers put out new discount cards, all of which followed the general system of advancing prices by lowering discounts 3½ points or $7 a ton on standard steel pipe and $10 and upward on oil well casing,

Changes in Discounts of Standard Steel Pipe

Date	Sizes in inches	Butt Weld Basing Black	Butt Weld Discount Galv.
Jan. 1, 1910 to Oct. 1, 1910	¼ to 6	78	68
Oct. 1, 1910 to Oct. 2, 1911	2 to 3	80	70
Oct. 2, 1911 to Dec. 1 1911	2 to 3	81	74
Dec. 1, 1911 to Dec. 15, 1911	2 to 3	83	76
Dec 15, 1911 to Jan. 1, 1912	2 to 3	83	76
Jan. 1, 1912 to July 1, 1912	2 to 3	82	75
July 1, 1912 to July 24, 1912	2 to 3	82	75
July 24, 1912 to Sep. 10, 1912	2 to 3	81	74
Sept. 10, 1912 to Jan. 1, 1913	2 to 3	80	72
Jan 1, 1913 to Apr. 12, 1913	¼ to 3	80	71½
Apr. 12, 1913 to May 27, 1913	¼ to 3	79½	71
May 27, 1913 to Aug. 8, 1913	¼ to 3	79	70½
Aug. 8, 1913 to Oct. 27, 1913	¼ to 3	80	71½
Oct. 27, 1913 to Feb. 2, 1914	¼ to 3	80	71½
Feb. 2, 1914 to Apr. 20, 1914	¼ to 3	79½	71
Apr. 20, 1914 to Nov. 2, 1914	¼ to 3	80	71½
Nov. 2, 1914 to Feb. 11, 1915	¼ to 3	82	72½
Feb. 11, 1915 to May 1, 1915	¼ to 3	80	69½
May 1, 1915 to June 1, 1915	¼ to 3	79	68½
June 1, 1915 to June 17, 1915	¼ to 3	79	63½
June 17, 1915 to Aug. 15, 1915	¼ to 3	79	57½
Aug. 15, 1915 to Nov. 1, 1915	¼ to 3	79	63½
Nov. 1, 1915 to Jan. 4, 1916	¼ to 3	78	63½
Jan. 4, 1916 to Jan. 20, 1916	¼ to 3	77	62½
Jan. 20, 1916 to Feb. 15, 1916	¼ to 3	76	60½
Feb. 15, 1916 to Feb. 29, 1916	¼ to 3	75	59½
Feb. 29, 1916 to Mar. 15, 1916	¼ to 3	74	57½
Mar. 15, 1916 to Mar. 29, 1916	¼ to 3	73	55½
Mar. 29, 1916 to Apr. 21, 1916	¼ to 3	72	53½
Apr. 21, 1916 to July 24, 1916	¼ to 3	70	50½
July 24, 1916 to Sept. 7, 1916	¼ to 3	70	55½
Sept. 7, 1916 to Nov. 1, 1916	¼ to 3	69	55½
Nov. 1, 1916 to Nov. 15, 1916	¼ to 3	69	55½
Nov. 15, 1916 to Dec. 4, 1916	¼ to 3	68	54½
Dec. 4, 1916 to Dec. 30, 1916	¼ to 3	66	52½
Dec. 30, 1916 to Feb. 14, 1917	¼ to 3	64	56½
Feb. 14, 1917 to Mar. 5, 1917	¼ to 3	62	48½
Mar. 5, 1917 to Apr. 2, 1917	¼ to 3	60	46½
Apr. 2, 1917 to Nov. 6, 1917	¼ to 3	55	41½
Nov. 6, 1917 to Jan. 1, 1919	¼ to 3	51	37½
Jan. 1, 1919 to Mar. 21, 1919	¼ to 3	54	40½
Mar. 21, 1919 to date	¼ to 3	57½	44

tubing, etc. Some producers adopted a policy of not announcing prices in a miscellaneous way even to jobbers but quoted when specification tonnage inquiries were placed before them with the statement that the usual additional discount to jobbers of 2½ per cent no longer would be effective.

Increases likewise were made in prices of welded iron pipe. One producer on Jan. 7 issued a card advancing oil country goods $10, but making no change in the price of merchant pipe. Another maker in a card of Jan. 16 left merchant iron pipe on the basis of its card of Oct. 29, 1919, but advanced oil country goods $10. This company in a card issued on May 1 marked up buttweld iron pipe 10 points in all sizes and weights, both black and galvanized, lapweld in all weights and sizes, black and galvanized, 8 points, and oil country goods $10 per ton.

Price Was Secondary Consideration

Prices proved to be of only secondary consideration and it was estimated early in February that makers were rejecting fully 10 times as much business as they were entering. Pressure for material was extremely strong, with mills sold far ahead and making slow progress in reducing obligations owing to the fuel, labor and car situation. Heavy inquiries also were made for drill and drive pipe and casing, and for miles of line pipe.

The nationwide strike of railroad switchmen in April further hampered the industry severely and in the face of the difficult situation in which makers already found themselves, large stocks began to accumulate and additional capacity to close down. By the middle of July deliveries were being made on orders placed as far back as early in 1919. At times the output of mills exceeded the threading capacity and this developed in slowing down the mills temporarily.

The labor situation proved a source of trouble and the Reading Iron Co. Reading. Pa.. employing 7000 men, was tied up from August until early in December for this cause.

Wire Production Falls Short of Demand

ENTERING 1920 with a famine in nails and wire, this branch of finished steel production had failed to catch up with demand when the year closed. It will be recalled that early in 1919 buyers were backward, but in the final part of that year they swarmed about producers, seeking to place tonnages far in excess of mill production. In slighly different degree the same condition persisted through the year just closed and at no time did producers reach a point where they could meet demand.

Following the policy of holding down prices, the leading producer maintained the industrial board schedule, despite higher quotations by other makers until in August, when there was an advance of $5 per ton on wire to 3.25c, Pittsburgh, and an arrangement of extras on nails which, however, left the base price unchanged.

Changes in prices and alterations of relations of nails and wire began in January when independent producers took up the consideration of a new nail card designed to absorb the increased cost of conversion, over plain wire. Two plans were considered, one for a wider base between wire and nails, and the other for higher extras. About the end of February the new cards were issued, carrying the base on nails at $4, per 100 pound keg, Pittsburgh, with new extras, superseding the card of Dec. 1, 1896. The extras were increased 22 to 27 cents per keg and the base was reduced 25 cents from that previously quoted. Cement-coated nails were reduced to $3.35 from $3.50, and new extras were announced.

While the American Steel & Wire Co. throughout the year sold nails at $3.25 per keg, Pittsburgh, independents early in the year took orders at $3 to $3.75, Pittsburgh, on wire and $3.25 to $4.50 per keg, Pittsburgh, on nails.

From the production standpoint the year was one of disappointment. Starting with an immense shortage and large order books, producers expected a period of heavy production, efficiency following the steel strike of 1919 having been restored. As early as January, however, cars became scarce and production outdistanced shipments.

In April this condition became serious and open cars were resorted to, the material being covered with paper for protection. Automobile trucks were also called upon and heavy tonnages were moved by this means of transportation.

With the return of the railroads to private ownership and gradual clearing of mill congestion, full production was resumed and heavier shipments followed. Even these shipments were insufficient to meet needs and jobbers were unable to accumulate stocks.

It was not until November that a measurable lessening of demand took place and even then it was not sufficient to effect mill operations severely, as nails, barbed wire and manufacturers' wire continued in strong demad. Jobbers found as much difficulty as ever in retaining stocks in their warehouses. Some decline in prices by a number of independents was made in December and the level maintained by the leading producer was adopted by several competing mills.

Plain Wire Prices, 1915-1920

Cents per pound, base, Pittsburgh

	1915	1916	1917	1918	1919	1920
January	1.31	1.95	2.95	3.25	3.25	3.00
February	1.35	2.10	2.95	3.25	3.25	3.00
March	1.40	2.23	3.08	3.25	3.20	3.50
April	1.39	2 25	3 18	3.25	3.00	3.50
May	1.35	2.45	3.45	3.25	3.00	3.50
June	1.35	2.45	3.60	3.25	3.00	3.50
July	1.39	2.45	3.95	3.25	3.00	3.50
August	1.42	2.53	3.95	3.25	3.00	3.50
September	1.54	2.55	3.95	3.25	3.00	3.50
October	1.62	2.575	3.85	3.25	3.00	3.50
November	1.72	2.80	3.25	3.25	3.15	3.25
December	1.83	2.95	3.25	3.25	3.25	3.25

Wire Nail Prices, 1915-1920

Cents per pound, base, Pittsburgh

	1915	1916	1917	1918	1919	1920
January	1.51	2.15	3.00	3.50	3.50	4.25
February	1.55	2.22	3.00	3.50	3.50	4.20
March	1.90	2.38	3.16	3.50	3.45	4.00
April	1.50	2.40	3.20	3.50	3.25	4.00
May	1.55	2.50	3.50	3.50	3.25	4.00
June	1.35	2.50	3.85	3.50	3 25	4.00
July	1.50	2 50	4.00	3.50	3.25	4.00
August	1.61	2.55	4.00	3.50	3.25	4.00
September	1.49	2.60	4.00	3.50	3.25	4.00
October	1.76	2.65	3.90	3.50	3.25	4.00
November	1.87	2.85	3.50	3.50	3.45	4.00
December	1.98	3.00	3.50	3.50	3.50	3.25

Plate Tonnage Steadily Falls

Momentum of Market in Previous Year Extends Through First Quarter and Premiums Are Paid—Business Then Shrinks and Prices Fall—Steel Corporation and Independent Mills Quote Uniformly for First Time in December

WITH the exception of the first three months, 1920 was a year of continued contraction of business in the plate market. In the first quarter the market retained the strong upward momentum developing from the scarcity of plates which became pronounced after the inauguration of the steel strike in September, 1919. The question of price at no time was the determining factor during the first quarter. While the subsidiaries of the United States Steel Corp., despite their large unfilled orders, at no time during 1920 asked higher than the 2.65c, base, Pittsburgh, price which was established on March 21, 1919, independent makers during the most of the year obtained premiums. The latter reached the peak in March, after which they grew smaller until, in December, most independent mills were quoting on the same basis as the Steel corporation.

In no year in history were obstacles to production more numerous or pronounced than in 1920. The curtailed output resulting served to stretch out the period over which premiums were paid. Although the steel strike officially was called off Jan. 8, 1920, other labor troubles held up production. One of these was the coal strike which, in some sections, tied up the mines over the greater part of the first half of 1920. In April there came the railroad strike, followed by "outlaw" railroad strikes of a minor but aggravating character. The shortage of railroad equipment was another bad handicap; due to the inability of the mills to move materials to or from the plants on an adequate scale, much production was lost by makers all over the country, and particularly those in the valleys. Even after the labor troubles had subsided, the shortage of railroad equipment continued to be an adverse factor.

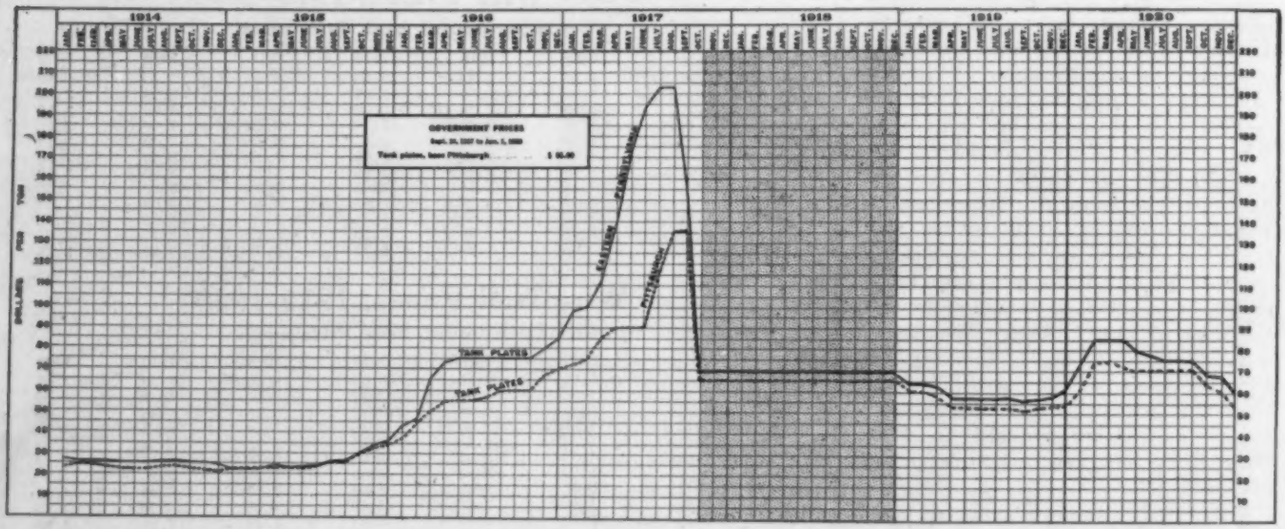
Demand was at flood tide when the year opened. While not all independent makers yet had abandoned the 2.65 and 2.75c, base, Pittsburgh figures, the prices of independent mills as a rule were 3.00c to 3.50c, and the latter figure freely was obtainable.

In February and March demand from the railroads and the makers of cars and locomotives began to assume large proportions, both for repair and new work. This business was given preference by the mills in their already crowded schedules. The effect of this buying was to swing prices rapidly upward, and fair sized sales for nearby shipment were made in some cases at as high as 4.50c, Pittsburgh. This price was done in numerous export transactions. In some cases mills quoted as high as 5.00c, although this figure, as far as known, was not done on any tonnage of importance. The price then most representative of the market was 4.00c, base, Pittsburgh, and there was considerable contract buying for second quarter.

Buying of plates for repairing cars and locomotives continued heavy all through the second and third quarters, and there was increased buying for the construction of new cars and locomotives. The mills gave such requirements the preference. With the exception of such buying, however, demand, generally, began to reflect a shrinkage by the end of March. Considerable second quarter contracting then developed at 3.25c, although the market on nearby deliveries remained at 5.00c, as the mills continued with large order books.

The first real weakness in the market developed in April and May. Mills had been having a great deal of trouble in shipping materials on export orders, due to the railroad congestion and, particularly, the longshoremen's strike, so that large export tonnages remained undelivered. In April there developed the reaction in the speculative market in Japan which later led to the cancellation of hundreds of thousands of tons of steel products on Japanese orders in this country. In addition, railroad embargoes were preventing shipments on domestic contracts in many cases. As a result, numerous mills suddenly found themselves with plates for prompt shipment on hand, and without being able to find a ready buyer. In this juncture premium prices dropped to 3.50 to 3.85c, Pittsburgh.

From then on the easier tone became more pronounced. In August, attractive tonnages, despite the fact that freight rate increases were about to swell producing costs, were taken by middle western independents at



TANK PLATE PRICES PITTSBURGH AND EASTERN PENNSYLVANIA 1914-1920. SHADED POLTION SHOWS PYRIOD OF GOVERNMENT CONTROL

3.25c and 3.00c, Pittsburgh. In October, tonnage was booked by independent makers at 3.00c, and as low, in some cases, as 2.65c, Pittsburgh.

It was not until Nov. 26, however, that the action of the Jones & Laughlin Steel Co. in publicly announcing a cut to the 2.65c, Pittsburgh, base, led most independents to adopt the price which the subsidiaries of the United States Steel Corp. had been observing since March 21, 1919. The independents who took this action in most cases not only quoted the 2.65c, price on new business but also applied it to unfilled orders. At the end of the year several independent mills were idle and most were operating at a reduced rate.

Ferroalloys Open Strong but Close Weak

HEAVY buying featured the ferromanganese market at the beginning of 1920. Before the end of January, domestic producers had enough unfilled orders on their books to absorb their entire output over the first half. By the middle of March domestic production, in some cases, was sold up to the extent of 75 per cent of the second half. All through the first half it was very difficult to obtain ferromanganese for prompt and nearby shipment and substantial premiums were paid. At the end of June there was some reselling at concessions. In August the market weakened perceptibly and not only was there insufficient buying definitely to determine prices over the remainder of the year, but the general slump in the steel industry led to greatly reduced consumption.

When the year opened, heavy selling of domestic ferromanganese at $120 to $130, delivered, and of English metal at $120 to $125, tidewater, moved up the market quickly. By the middle of February, when forward deliveries were bringing $145, tidewater, to $160, delivered, supplies had become so scarce that spot carloads brought $200, delivered, and in some cases consumers unsuccessfully bid $225. A feature was that domestic producers who had covered for their ore for the year, were asking a higher price for third quarter alone than for the entire second half. Late in March spot sold at $225 to $250, delivered, and the contract price on domestic metal moved up to $200, delivered. This was followed by an advance to $195, tidewater, on English metal.

These figures, which represented the highest levels reached during the year, prevailed with little variation until the latter part of June. Then some tonnage for nearby shipment was disposed of at resale at $190 and $195, delivered. From then to the latter part of August, resales for prompt shipment at prices ranging from around $190 to $225, delivered, comprised the bulk of the market activity. Late in August, both importers and domestic producers took several thousand tons for the remainder of the year on the basis of $170, tidewater. Resales then again dominated the market up to the end of November, this business going from $135 to $165. Early in November, producers reduced their quotations to $150, delivered, on domestic and to $140, tidewater, on English metal, but without attracting any business. Resales absorbed most of the demand until the end of the year, the price ranging from $100 to $135, delivered.

Domestic makers, at the beginning of the year, lowered their standards from 78 to 82 per cent to the 76 to 80 per cent base of the British producers. This change was made because of the character of the ore thus being received.

Spiegeleisen traced much the same market course as ferromanganese, but was much stronger, comparatively, during the second half. The buying wave at the beginning of the year found the market on 20 per cent spiegeleisen at around $45, furnace, but carried it upward steadily until it reached $75 in April. Despite some reselling at concessions in July, the tone of the market continued strong. In August the market advanced to $80 to $85, this level being maintained over September. In October, the minimum price was $80. In November there were resales at $65, furnace. In December metal could be had at first hand at this figure while the resale market was lower.

SPIEGELEISEN PRICES

	1920	1919	1918	1917	1916
January	$46.60	$67.50*	$59.00	$57.50	$32.50
February	57.00	52.50*	59.00	66.25	42.50
March	60.40	42.50*	65.50	77.50	55.00
April	66.85	34.50*	70.00*	76.75	60.00
May	75.00	31.35*	71.00*	78.00	60.00
June	75.00	27.50*	75.00*	83.00	55.00
July	75.00	34.00	75.00*	85.00	47.50
August	79.35	34.00	75.00*	81.25	47.50
September	82.00	34.00	75.00*	80.50	45.00
October	80.00	34.00	75.00*	73.50	40.00
November	74.35	34.00	75.00*	63.25	45.00
December	....	39.00	72.50*	60.00	50.00

*Prices from and including April, 1918, and to and including June, 1919, are for 16 per cent spiegeleisen. All other prices apply to 20 per cent metal.

FERROMANGANESE PRICES

	1920	1919	1918	1917
January	$146.00	$212.50*	$250.00	$175.00
February	160.00	165.00	250.00	192.00
March	172.00	134.00	250.00	212.50
April	200.00	113.75	250.00	250.00
May	200.00	110.00	250.00*	375.00
June	198.00	111.75	250.00*	400.00
July	190.00	111.00	250.00*	400.00
August	195.75	110.00	250.00*	387.50
September	167.00*	105.00	250.00*	380.00
October	151.00*	110.00	250.00*	300.00
November	153.00	110.00	250.00*	247.50
December	.....	121.00	236.00*	247.50

*Prices from May, 1918, to January, 1919, inclusive, were based on 70 per cent ferromanganese. All other prices in above table were based on 80 per cent metal.

Prices of 50 per cent ferrosilicon showed little change all year. They were being quoted $80 to $85 in December, 1919, and remained at that level in December, 1920.

Ferrovanadium was an exception to the rule most of the year. Scarcity of high grade alloy of low silicon content, existing when the year opened, later became pronounced and the price advanced from $7 to $9 a pound contained. The leading maker held its price on high silicon alloy at $6.50, base, most of the year, but was unable to supply all the requirements of high grade, with a resultant excited outside market. Toward the close of the year, after the automobile business slumped, high-grade ferrovanadium sold down to $7 and closed the year at that price.

Although domestic makers of ferrotungsten were quoting $1.10 to $1.20 a pound contained for ferrotungsten when 1920 began, foreign material was offered at great concessions to levels where domestic producers could not compete. As 1920 closed, foreign alloy was sold down to 57½ cents a pound contained, as against a prewar average price of about 70 cents.

The 1920 contracts for ferrochrome of 60 to 70 per cent chromium and 6 to 8 per cent carbon placed by alloy steelmakers with domestic producers, were mostly at a range between 18 to 19 cents a pound contained. This price obtained nominally all during the year. Imported alloy, containing 6 to 8 per cent carbon, due to the exchange situation, was offered most of the year at 16 to 17 cents, exstore, New York. These prices obtained as the year drew near a close.

Structural Conditions Contrast

Year Shows Wide Difference in Volume of Demand and Production Factors Between Opening and Close—Awards Approximately Equal to Those of 1919—Mills Close Year with Limited Shape Bookings

HIGHLY contrasting conditions influenced the structural steel market in 1920. This fact becomes especially pronounced by a comparison of the opening and closing few months of the year. In these periods not only a wide difference in the volume of demand, but also a marked change in production factors, such as labor, fuel and transportation, are shown. However, despite a lack of steadiness, the market was featured by considerable trading, and compared favorably in this respect with the preceding year, although the order of the placing of business was reversed. In 1919, the bulk of the year's trading came during the last half.

Practically all shape mills and fabricating shops entered 1920 with substantial bookings. The mills had little tonnage available for first quarter shipment, and most of the shops were sold ahead for four to five months. This situation early was affected by the placing of considerable additional business. January proved to be an active month. February was the busiest in almost two years and by far the most active in 1920. Shape bookings were so advanced that by the end of February, most of the independent mills were practically sold up for the first half, and the Steel corporation, for the entire year. At the same time, independent shape prices advanced sharply. During the first two months, the market went from 2.55c and 2.75c, Pittsburgh, to 3.75c and 4.00c, Pittsburgh. This development in conjunction with advanced deliveries and severe fuel and labor shortage retarded new inquiry, especially in the Middle West, but throughout March buying continued well in excess of shipments. However, shipments had been forced down. Many of the mills were unable to get their production up to more than 60 per cent, and consequently their deliveries became greatly unsettled; so much so that some mills, and also several of the fabricating shops were forced to withdraw from the market temporarily. However, bad as this situation was, it was made worse in April by the switchmen's strike which practically paralyzed industry for several weeks, and reached a climax late in the month. For a short time prior to the strike, deliveries showed a slight improvement, but this advantage soon was lost.

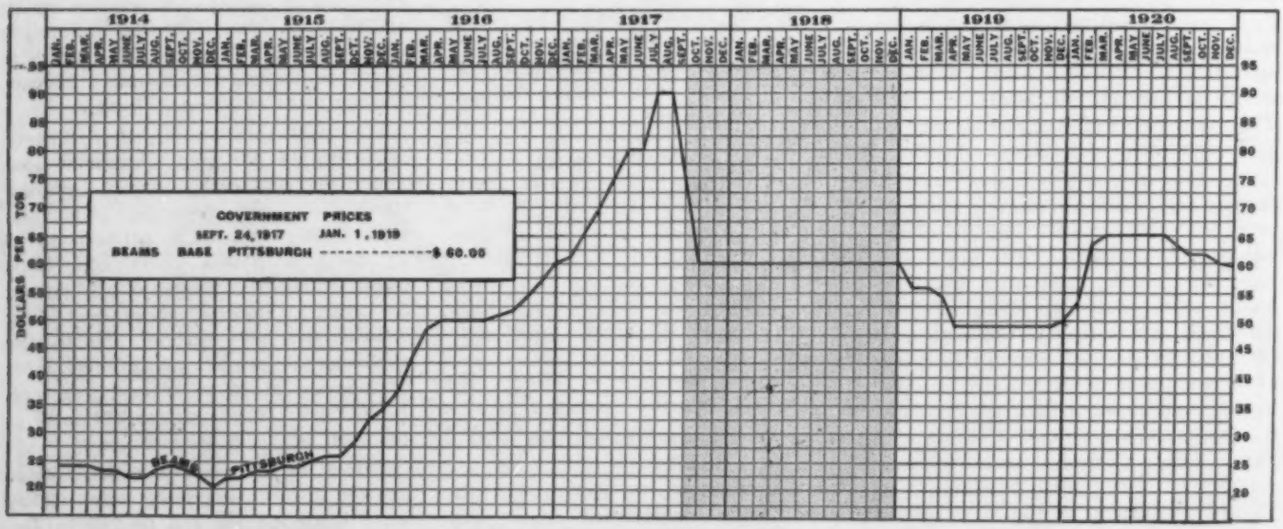
Shipments Made Impossible

Under such conditions, trading gave way perceptibly. Business in the Cleveland and Chicago districts was the lightest in months, and the eastern districts also were affected. In May, the dullness became still more pronounced, the rapidly tightening money situation becoming a deterring factor. The mills and fabricating shops became less active, but this was not due so much to a lack of orders, as to the fact that shipments, except in trainloads, still were almost impossible. Only such mills as were rolling the smaller sizes, such as could be stocked, were able to operate at anything like normal.

This situation prevailed in a greater or less degree throughout the remainder of the second quarter. The strike gradually dwindled away, but the heavy accumulation of freight at all the principal shipping points, tieing up thousands of cars of which already there was a marked shortage, continued to interfere with transportation and, in turn, made operations difficult.

Despite this enforced curtailment of production, however, prices, which had been showing a tendency to soften for some time, dropped off to a maximum of about 3.50c, Pittsburgh, by the end of the first half. By the end of July they had declined to 3.25c, and shortly after to a range of 3.10 to 3.25c. This latter range generally was maintained through the remainder of the third quarter, although in August there was a tendency among some mills, in view of freight advances in September, to increase their prices, and one large eastern maker marked up quotations from 3.25c to 3.50c, Pittsburgh. Throughout the entire quarter demand was listless and by the end of September, the fabricating shops had but about two and one-half full months' work on their books.

In the final quarter events moved swiftly. Early in October, prices again sagged off. One eastern mill dropped its quotation to 2.90c, Pittsburgh, and in the Chicago district, as low as 2.70c, Pittsburgh, was reported.



STRUCTURAL SHAPE PRICES 1914-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

Resale material became a factor, although a relatively small one, and on this business as low as 2.75c was done. In addition, October was featured by a marked improvement in transportation and labor showed a greater tendency to settle down. Mill operations increased to around 80 per cent of capacity. Tonnage was worked off the books so much faster than it was taken on that by the middle of November stock shipments on certain sizes were offered by some independents and first rollings were available in practically all cases. Later, with business continuing of negligible proportions the mills were slowed down in an effort to string along their tonnage.

Possibly the most interesting price development of the year came early in December, when several of the independent producers in the Pittsburgh and Youngstown districts reduced their quotations to the 2.45c, Pittsburgh, level of the United States Steel Corp. A western independent about a month previously had met the Steel corporation price at Chicago, but up until December, no such action had been taken in the East. While a few mills did not immediately follow, shapes soon were generally available at the new price. One large eastern independent on a special tonnage even shaded the 2.45c, Pittsburgh, price by about 5 per cent.

Investigation Curbs Buying

In the New York district, structural buying was depressed during the final quarter of the year by an investigation by the Lockwood legislative committee into building operations in New York City. Graft and coercion by threat of strike were alleged and many leaders in the building trades were implicated. So startling were some of the exposures that a nationwide inquiry by congress is imminent.

An analysis indicates that business placed in 1920 was confined principally to apartments, office and loft buildings. There was relatively little industrial building, and a goodly portion of such of the latter as was carried out was devoted to alterations and additions.

An index to the volume of structural business in 1920 may be found in the monthly tonnage awards as reported by the Bridge Builders' and Structural society and herewith appended. This shows an average for the year of about 56 per cent of the total shop capacity of the country.

	1920	1919	1918	1917
January	135,000	21,000	95,400	119,000
February ..	171,000	22,500	90,900	106,000
March	150,400	32,300	84,600	132,000
April	122,250	48,100	115,300	110,000
May	110,700	88,200	108,000	102,000
June	90,400	117,000	100,800	85,500
July	90,400	133,200	209,700	74,700
August	72,000	141,000	162,000	68,400
September ..	77,400	141,000	108,000	52,200
October ...	45,600	139,500	77,400	110,700
November ..	49,200	134,300	48,700	138,600
December		153,000	52,270	205,200
Total 1,114,350	1,161,400	1,201,970	1,294,300	

Rail Orders in Heavier Volume in 1920

RAIL buying in 1920 was in heavier volume than for years past. At the beginning of the year the mills had on their books tentative contracts for the 1920 requirements of most of the railroads of the country. When it became assured that the railroads on March 1 would revert to private control, these contracts immediately were ratified, and additional tonnage was placed by roads which previously had not acted.

The major portion of the 1920 tonnage was supplied by subsidiaries of the United States Steel Corp. at the prices established March 21, 1919, namely, $45, base, mill, for standard bessemer, and $47 for standard open-hearth rails. Prices on most of the tonnage furnished by the independent mills in 1920 were $55 and $57, base, mill, respectively, on standard bessemer and open-hearth rails. After the bulk of the 1920 buying came to an end about the middle of February, however, independent mills in some cases advanced their prices, and a fair amount of tonnage in the aggregate was entered up to September at prices ranging from $65 to $70, mill. At least two makers entered some tonnage in September and October at $62.50, while all independents in November and December quoted $55 and $57, or $10 higher than the Steel corporation's level. As a rule, independent producers were not anxious for rail tonnage during 1920 owing to the fact that it was more profitable to sell their steel in other finished forms.

The railroads early showed concern with respect to their 1921 requirements and inquiries for large tonnages began to come out as early as March. Tonnages for 1921 began to be entered on mill books in August. It was estimated late in December that the total bookings for 1921 by the end of the year would aggregate at least 2,000,000 tons. A feature of this business was that no prices were included, those being left until the end of the year for determination. Later, after the announcement by Judge Gary of the intention of the Steel corporation to continue the prices of March 21, 1919, the Steel corporation subsidiaries inserted the $45 and $47 base figures in 1921 contracts. At the middle of December, however, independent makers had not decided finally what to quote on their 1921 contracts because wage adjustments contemplated on Jan. 1, 1921 had not been settled.

A development which aroused much discussion early in the year was an order by the war department, on Jan. 21, commandeering 72,500 tons of rails to be rolled immediately for the railroad administration. This order, which was distributed among the various mills at a time when they were filled up with tonnage, pre-empted space. It was felt the mills should have been engaged for the tonnage by the railroad administration the previous year when they were urgently in need of the business. Furthermore, the war department had just sold to a broker in New York, at $40, a ton, 57,000 tons of rails of a type included in the commandeering order. The latter it sought to place at $47 for open-hearth rails, despite the fact that the independent makers had advanced to $57. Rolling of these rails for the railroad administration was completed prior to March 1.

Car buying during the year was triple that of 1919; however, the volume was well below many earlier predictions. Approximately 63,740 cars were placed. By far the heaviest buying came in April, when more than 18,000 cars were awarded. The next largest month was May, with about 7000 cars placed. Export demand was quiet throughout the year. Not more than 5000 cars were placed for shipment abroad.

Following is a comparative statement of the railroad car orders by months in recent years:

	1920	1919	1918	1917
January	3,120	5,180	200	15,000
February	7,030	60	4,575	7,750
March	4,220	150	2,190	21,500
April	19,330	575	81,150	4,250
May	7,100	300	70,185	15,000
June	4,025	1,010	400	8,200
July	5,510	2,510	30,000	8,650
August	6,980	2,125	10,000	13,000
September	1,800	3,975	4,000	1,100
October	4,435	4,750	40,900	42,500
November	....	350	200	10,000
December	2,000*	1,000	8,000*	1,900
Total	65,740	20,045	201,750	148,350

*Estimated.

Locomotive orders involved about 2200 in 1920 of which possibly 1000 were for export. The greatest activity in this market was also in April, when orders aggregated about 500.

Automobile Slump Hits Sheets

1921 Market Opens with Rising Prices and with Consumers Bidding Against Each Other for Supplies — Closes with Many Requests for Suspended Shipments and Prices on Minimum Basis — Producers Encounter Various Obstacles

EXTREME scarcity, eager demand, high prices and low operations due to poor transportation, characterized the sheet industry up to August of 1920. Then followed the virtual demoralization of the automobile trade, and an almost opposite market situation in sheets developed. Requests for suspensions of shipments began to pour into mills, demand became light, the market broke sharply and operations were curtailed. Prices of sheets at the end of the year were on the American Sheet & Tin Plate Co. basis, or $4 a ton lower on No. 10 blue annealed; $13 on No. 28 black and $11 on No. 28 galvanized, as compared with those which independents had maintained when the year opened. The collapse that developed in the automobile trade seldom has been equaled in industrial annals.

Obviously the mills which suffered most from the request for suspended shipments were those which had taken contracts at the highest prices. Throughout the year the American Sheet & Tin Plate Co. maintained the industrial board prices of March 21, 1919, calling for 3.55c, Pittsburgh, for No. 10 blue annealed; 4.35c for No. 28 black and 5.70c for No. 28 galvanized. It opened its books on Dec. 2 for the first half of 1921 at these prices, and most independents soon after adopted similar levels.

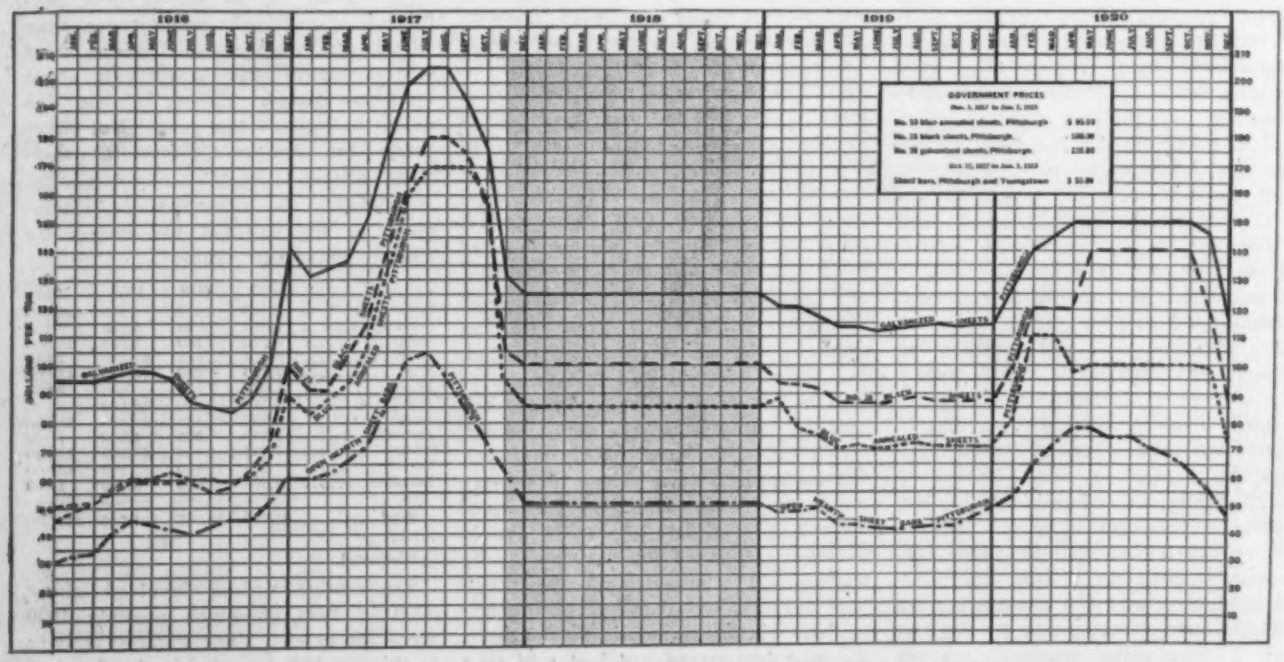
Prices of sheets in 1920 ran as high as 11.00c and 12.00c for No. 28 black, and even 15.00c for some lots for early delivery. The spread between the price on this grade and galvanized became so narrow that makers preferred contracts for the former because they were the more profitable. A price situation of this kind obtained in May, when blue annealed prices ranged from 7.00c to 8.00c or more. These levels compare with 3.75c for blue annealed, 5.00c for black and 6.25c for galvanized sheets which were current when the year opened. The irregular course of the market thus is clearly shown.

Industry Is Retarded

The year began with a shortage of sheet bars and an inability of the sheet mills to reduce orders which had accumulated over the last quarter of 1919 as a result of the steel and coal strikes. The switchmen's strike in April further retarded the industry and resulted in suspension of a large capacity. By that time some mills could not promise delivery before the first of August, all plants in the various districts being affected similarly. The demand from foreign sources likewise was heavy and much was refused. In May, improvement in shipments through movements of solid trainloads, developed and operations were resumed on a larger scale, although there were exceptions as in the case of Mahoning valley mills. A Chicago maker at this time was selling to old customers for the third and fourth quarters on a basis of 5.27c to 5.77c, Pittsburgh, for No. 10 blue annealed; 6.27c to 6.77c, Pittsburgh, for No. 28 black and 7.77c to 8.27c, Pittsburgh, for No. 28 galvanized. Independent producers in other districts were on about the same basis.

Current prices, however, still fluctuated widely and black sheets were being sold at this period from 11.00c to 12.00c for shipment in two to three weeks, and the market continued to show a rising tendency. Demand was unabated and found its reflection in still higher prices. Blue annealed sheets were sold between 7.00c and 8.00c.

The breakdown in the automobile industry was reflected the forepart of August when sheetmakers began to hold up hsipments "pending adjustment of shop methods in order to manufacture 1921 models efficiently." Shipments, while still restricted, had gone forward in better shape and the heavy stocks of sheets in warehouses had been considerably reduced. Mill op-



PRICES OF SHEETS AND OPEN-HEARTH SHEET BARS 1916-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

Average Monthly Prices Sheets 1916-1920

Cents per pound, Pittsburgh

	January	February	March	April	May	June	July	August	September	October	November	December
No. 28 BLACK SHEETS												
1916	2.55	2.60	2.75	2.90	2.95	2.90	2.90	2.75	2.85	3.20	3.65	4.50
1917	4.55	4.55	5.05	5.75	7.00	8.15	9.00	9.00	8.75	7.75	5.30	5.00
1918	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
1919	4.70	4.70	4.60	4.35	4.35	4.30	4.30	4.35	4.35	4.35	4.35	4.35
1920	5.00	6.00	6.00	6.00	7.00	7.00	7.00	7.00	7.00	7.00	6.05	4.47
No. 10 BLUE ANNEALED SHEETS												
1916	2.45	2.60	2.85	3.00	3.05	3.10	3.00	3.00	2.90	3.15	3.30	4.00
1917	4.15	4.40	4.70	5.35	6.65	7.55	8.50	8.50	8.50	7.85	4.60	4.25
1918	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
1919	3.90	3.90	3.80	3.55	3.55	3.50	3.50	3.55	3.55	3.55	3.55	3.55
1920	4.05	5.50	5.50	4.85	5.00	5.00	5.00	5.00	5.00	5.00	4.95	3.65
No. 28 GALVANIZED SHEETS												
1916	4.75	4.75	4.80	4.85	4.85	4.80	4.35	4.25	4.20	4.45	5.05	6.25
1917	6.55	6.50	6.70	7.55	8.80	9.95	10.25	10.25	9.70	8.80	6.50	6.25
1918	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25	6.25
1919	6.05	6.05	5.95	5.70	5.70	5.65	5.65	5.70	5.70	5.70	5.70	5.70
1920	6.35	7.00	7.25	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.35	5.85

erations then were at the rate of approximately 75 per cent of capacity. Total mill bookings at this period were estimated at 840,000 tons. Much effort was made by automobile manufacturers to have contracts revised downward, with some success in certain cases, but it is claimed they were able to cancel but little tonnage.

During the past year 62 new hot sheet mills were placed in operation. The American Rolling Mill Co. installed four, the American Steel Co. one, Apollo Steel Co. six, Bethlehem Steel Co. 10, Canonsburg Steel & Iron Works two, Eastern Rolling Mill Co. eight, Falcon Steel Co. eight, Newton Steel Co. 10, Otis Steel Co. one, Reeves Mfg. Co. one, Seneca Iron & Steel Co. two, Superior Sheet Steel Co. eight, and the Watertown Arsenal one.

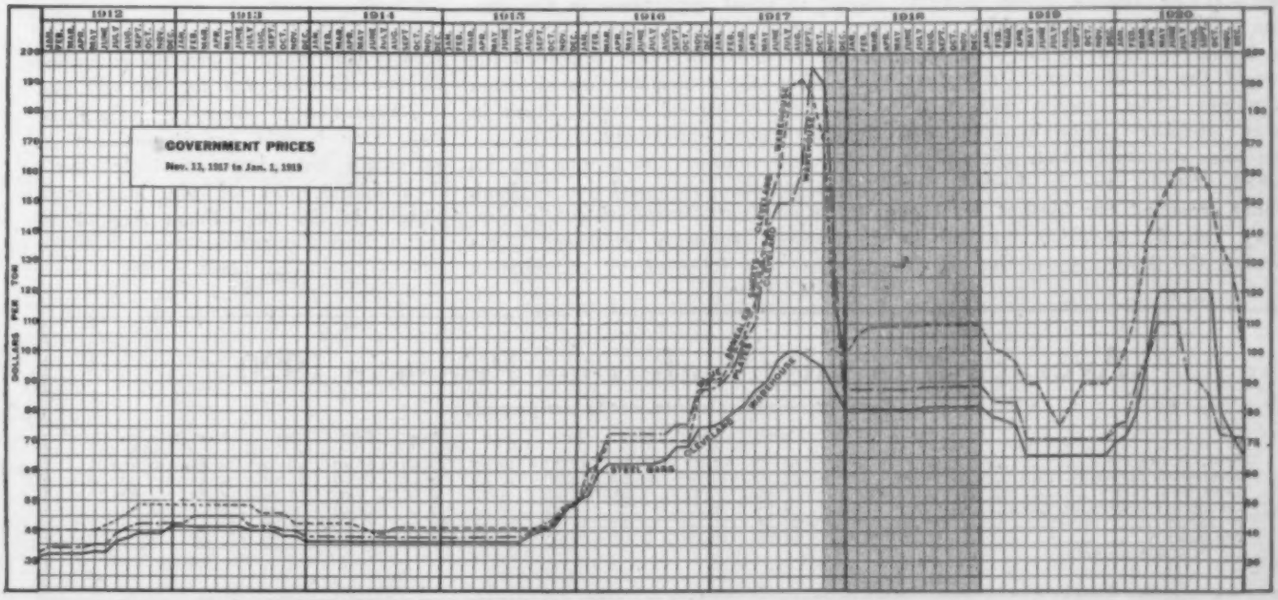
Warehouse Prices at Two Levels

FOR most of the year the warehouse iron and steel business of the country was done on two levels, stores of the steel corporation adhering to the level established in March, 1919, while independent jobbers made considerable advance from those quotations, the movement starting in January and continuing until the middle of the year, when it ceased. When railroad rates were increased in September store prices were marked up to include the heavier transportation cost, all interests making an advance at that time equal to the freight rate advance. In October several independent stores quoted lower on plates, shapes and bars and a movement back to the Steel corporation level was started. In November the decline had become general and the year ended with jobbers virtually quoting all lines on the corporation basis.

After the heavy selling of 1919, stores entered 1920 with depleted stocks, this situation continuing until nearly the end of the year, when conditions at mills permitted better shipments to stores. At the close of the year assortments had been built up to a point that had not existed for four or five years.

The final quarter was comparatively quiet for warehouse dealers, although the volume of business was sufficient to keep them busy. Pricemaking methods changed during 1919 and were followed in 1920 without alteration.

With a uniform level of quotations and stock built up to a normal assortment, stores in general face 1921 with every expectation of giving better service than has been possible for several years past.



PRICES OF LEADING WAREHOUSE PRODUCTS, CLEVELAND, 1912-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

Year Unsatisfactory in Metals

Opens with Heavy Order Books and Profitable Prices but Closes with Depressed Demand and Curtailed Output—Exchange Demoralization Affects Market—Much Tonnage Exported to Europe Sold Back to This Country

TAKEN as a whole, 1920 was an unsatisfactory year to most miners and smelters of nonferrous metals. The year opened auspiciously, with large orders, at profitable prices, on sellers' books. But it ended in extreme depression, with adoption of measures to curtail output and reduce costs, the rule in most of the metal industries. A review of the year's markets is a history of this transition from prosperity to hard times. For example, the copper producers booked orders for 481,000,000 pounds of copper in December, 1919, for early 1920 delivery; in November, 1920, they received orders for only 36,000,000 pounds, including both export and domestic business. Similar decreases in new business were experienced by producers of zinc, lead, aluminum and other metals. Results in the first half of 1920 were fairly satisfactory, excepting perhaps to the lead producers, who still were shipping high priced metal until well into November.

The metal markets suffered from a series of sharp blows throughout the past year. The first important retarding influence was the break in sterling exchange, which began after the British government support was removed in the autumn of 1919. Sterling exchange was quoted about $4 Dec. 1, 1919, declining rapidly from that level to below $3.20 on Feb. 4, 1920. Simultaneously, the British metal markets advanced steadily in the British postwar boom, in ratio to the decreased value of the pound sterling in American money. The London market advanced steadily through February, when some extremely high prices were touched. Straits tin, in London for instance, reached the highest level in history Feb. 25, at £420, but late in February, the British speculative bubble bursted and the remainder of the year showed almost steady declines in London, with only occasional recoveries. Dating from this time, the previously important export outlet of the United States was doomed; the London markets, in fact, descended to such low levels in comparison with the American that considerable metal which had been exported to Europe was shipped back to this country and these imports, with the threat of still further imports, sufficed to drive down prices here. Lead was particularly hit by imports. In the months of September and October alone, imports of lead amounted to over 30,000 tons, including lead contained in pigs, concentrates and bullion, of which nearly 20,000 tons were pig lead.

Factors Affecting Metal Markets

The American metal markets first felt the worldwide effects of the chaotic international credit situation, while continuing to enjoy a brisk domestic demand. Then the railroad strike began, in April, interfering with operations of both producing and consuming plants and causing the tieing up in transit of huge quantities of materials. About the same time, unskilled labor in the Waterbury, Conn., brass mills went on a strike for higher wages and recognition of the union, when demand for brass and copper products was insatiable. This was a factor of great importance in the copper market. The effects of the traffic tieup were felt until well into the fall, when the transportation situation eased up because of slowing down in general freight movement.

By late summer the automobile industry, affected by restriction of bank credits and curtailment of public buying power, suddenly collapsed. This collapse was followed by cancellation of orders for materials of all kinds, by requests for postponement of shipments and by lack of new buying for the rest of the year by automobile builders and accesory manufacturers. As a result, brass mills felt a quick decline in their order books; battery makers ceased buying lead and zinc; solder and bearing metal makers received cancellations and accordingly canceled orders for tin, lead and antimony; the brass and aluminum foundries were hit hard; body makers quit buying aluminum sheets. Aware of the trend in the market induced by the slump in activity in the automobile industry, buyers in other lines held back, waiting developments and by the end of the third quarter of the year, it was a buyers' market in all metals. The fourth quarter of the year inaugurated a period of curtailment of output and revision of wage scales. Mines and smelters were closed in all the metal industries, zinc being hit hardest of all. Production of zinc declined by December to about 25 to 30 per cent of the capacity attained during the height of the war production, in 1917.

The tin market was dull a large vart of the year. The zinc industry suffered acute depression the last half of the year, with lack of demand both from brass mills and galvanizers and the export outlet, which accounted for 15,000 tons monthly the first six months, practically closed.

The lead industry enjoyed great activity and good prices all year, until the London market so declined in August that heavy tonnages of lead were bought for importation at extremely low prices relatively. More than 30,000 tons of pig lead were bought in Europe. From Aug. 1 to Dec. 1, lead prices were reduced to 5.00c. New York and St. Louis.

Average Monthly Nonferrous Prices in 1920

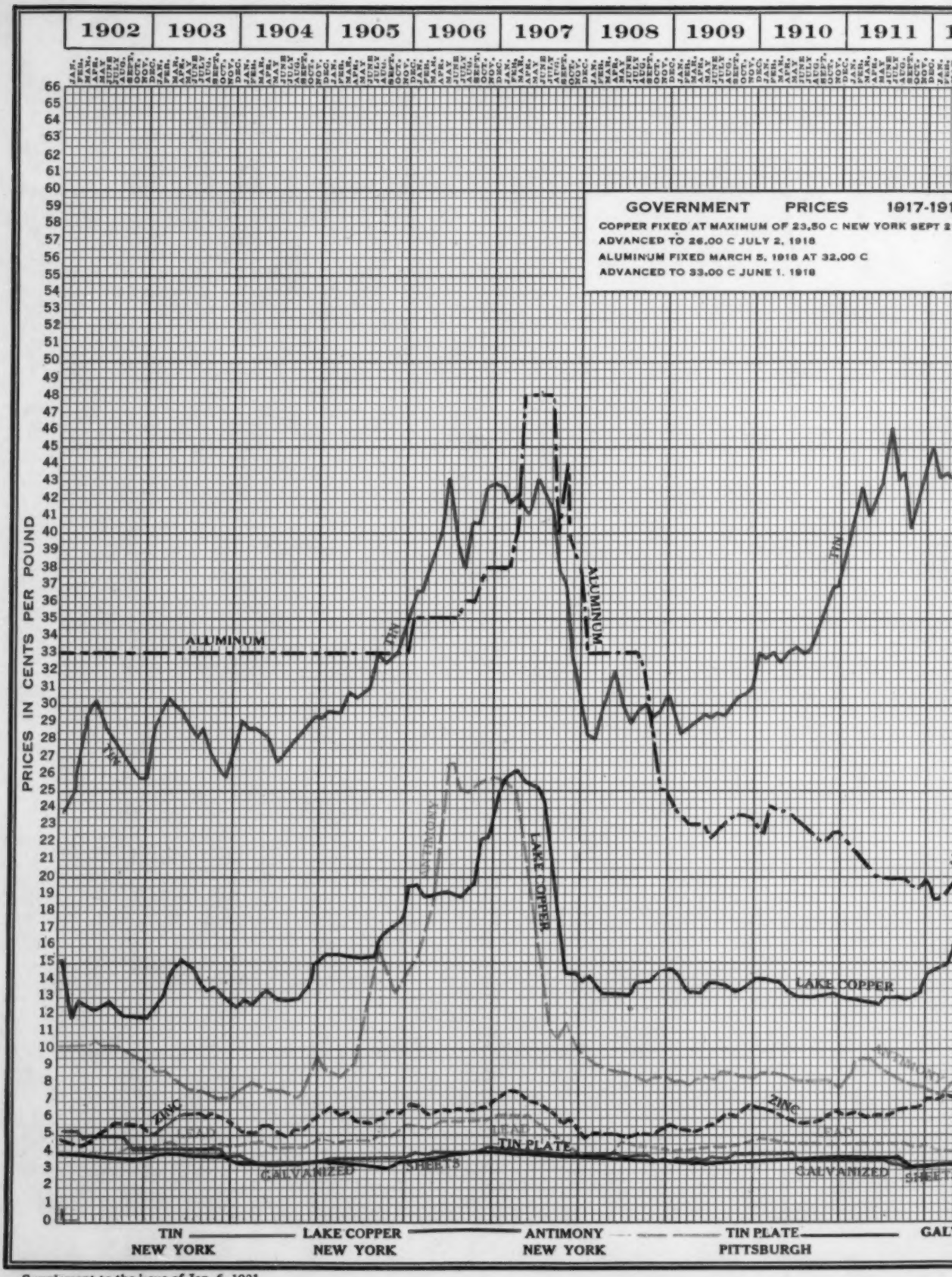
Prompt, wholesale lots, cents per pound.

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec. to 20th
Spot, Straits, tin	62.77	59.92	61.92	62.24	55.01	48.13	49.07	47.60	44.63	40.52	36.89	34.50
Electrolytic copper, N. Y.	18.91	18.99	18.58	19.18	19.09	19.00	18.60	18.43	18.03	16.02	14.41	13.87
Lead, New York*	8.78	9.03	9.25	8.87	8.70	8.68	8.77	8.76	8.06	7.28	6.30	4.87
Zinc, prime western, St. Louis	9.21	8.82	8.62	8.27	7.71	7.55	7.84	7.93	7.82	7.24	6.35	6.00
Aluminum	33.00	33.00	33.00	33.00	33.00	33.00	33.00	35.00	34.50	33.00	33.00	33.00
Antimony	10.49	11.87	11.06	10.49	9.57	8.09	7.49	7.08	7.13	6.70	6.07	5.75

*Outside market.

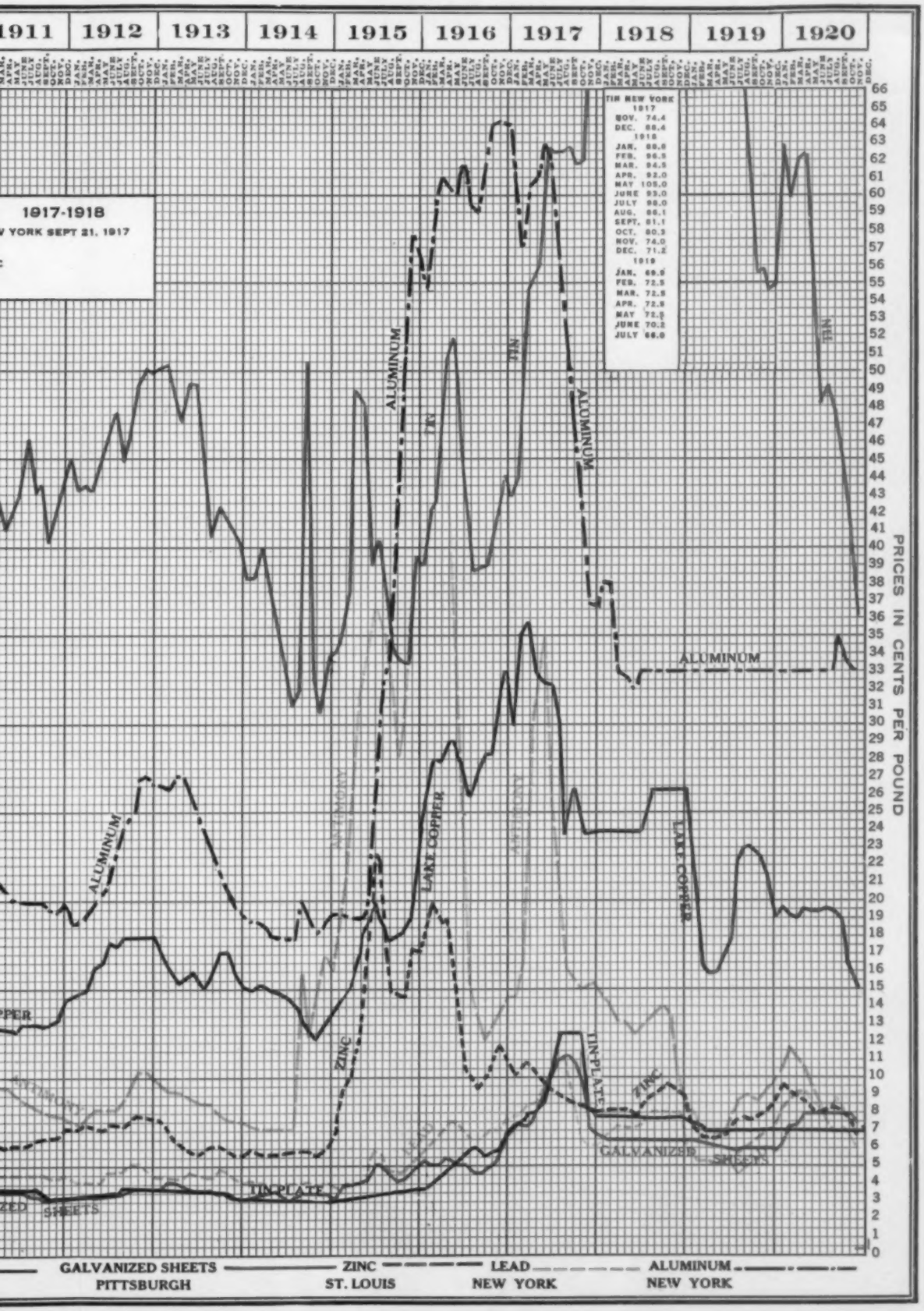
THE IRON TRAD

Fluctuations in prices of pig tin, aluminum, antimony, lake copper,



RADE REVIEW

copper, zinc, lead, tin plate and galvanized sheets, 1902-1920



Scrap Liquidation Is Complete

Erratic Demand Caused Fluctuating Prices Which Turned Sharply Downward in Last Quarter—Trade Is in Good Position for 1921 Developments—Accumulations Are Not Excessive—Effect of Higher Freights

WITH government scrap practically liquidated during the preceding year, the iron and steel scrap market entered 1920 with a clean slate and was prepared to proceed without the handicap of oversupply. Though many difficulties had presented themselves in 1919 such as strikes and other impediments to the orderly conduct of business, it had been possible to clean up and absorb the debris of war stocks.

As a result of this condition the scrap market held with fair consistency to a level keel through the first nine months of the year, variations being $2 to $4 per ton from high to low in many important grades during this period. There was a general upward movement in price through the first four months, and a gradual decline during the remaining months of the year, which became decidedly rapid in September. The last three months registered a larger total loss in price than the entire three quarters preceding.

An interesting feature of the year's changes is found in the fact that large centers, such as Pittsburgh, where scrap is produced in less volume than consumed, were forced to pay a relatively higher price after September, the imposition of higher freight rates in that month proving a barrier against inbound shipments from other centers.

Accompanying tables of average quotations in various centers illustrate this situation clearly.

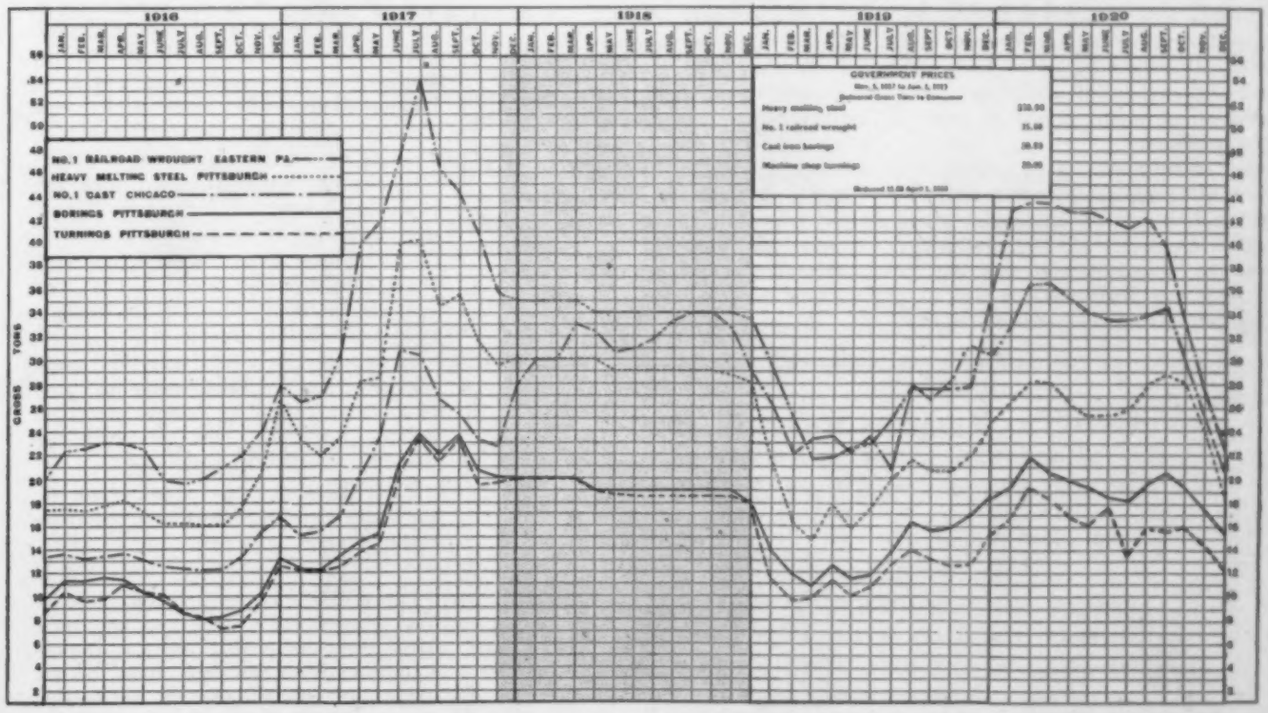
Speaking generally the scrap market moved downward during 1920 more than it moved up. For example, heavy melting steel started the year at $26.60 as the January average at Pittsburgh and $24.25 at Chicago. In February these figures had advanced to $28.50 and $25.05 respectively but from then on the tendency was generally downward during the remainder of the year, with some slight reactions, until November gave an average of $24 at Pittsburgh and $18.50 at Chicago. In December there was a further reduction of $5 at Pittsburgh and $1.75 at Chicago. Most other grades followed more or less similar curves. Heavy melting steel did not pursue a similar course, though its highest selling price may have been above the cost of production of direct metal at some steel works.

Not a little difficulty was experienced at times during the year as a result of restrictions on the use of open top cars. Efforts to divert this class of cars to the fuel trade made it impossible at times to obtain sufficient equipment to move scrap.

In January the influence of delayed pig iron deliveries became evident and cast scrap began to soar. The price reached $42.50 at Chicago in that month and continued upward to an average of $44.10 in April. At Pittsburgh it was relatively lower, averaging $32.50 in January and reaching its early high in February at $41.50. Later on, in September, the Pittsburgh market reached its highest point with an average of $42.20. Late in January heavy buying of steel scrap was marked in all consuming centers, a fact which was registered in the average price for February. Prices began to recede after the second month because of lessened demand.

In March there was renewed demand for steel grades and prices became firmer. At this time scarcity of labor became so pronounced that dealers found difficulty in operating their yards. The banks also began to contract credits and at the high level of quotations it was difficult for small dealers to finance themselves. April was a dull month.

Rejections began to appear in such



AVERAGE MONTHLY SCRAP PRICES 1916-1920. SHADED PORTION SHOWS PERIOD OF GOVERNMENT CONTROL

numbers in May that it became apparent consumers did not need scrap. Conditions which caused the acceptance of anything shipped as scrap then had passed and inspection was made more effective. The railroad situation became more acute about this time and it was difficult to get tonnages through. Resistance to decline became more apparent and near the middle of the year there was an upturn which was regarded by many as marking the end of the dip in prices. A brief buying movement in July added to this impression. Prices moved upward and remained higher for about 60 days. This condition remained in effect into September and was featured by some heavy buying by United States Steel Corp. subsidiaries.

At the beginning of the final quarter the general business reaction set in and expectations of a market were nullified. The railroad situation had improved, mills had cleared their yards, fuel was moving better and the downward trend of business had set in.

Practically all grades dropped steadily and rapidly through the final quarter. Prices approached closely to the depressed point of early 1919, which was the lowest level in years.

On the whole the scrap trade is in a better position than most other departments of the iron and steel industry and there does not seem to be cause for apprehension in 1921.

The average monthly prices on heavy melting steel at Pittsburgh, Chicago and eastern Pennsylvania during 1920 are as follows:

HEAVY MELTING STEEL

1920	Pittsburgh	Chicago	East. Pa
January	$26.50	$24.25	$24.35
February	28.15	25.05	25.25
March	28.00	24.20	25.25
April	26.40	23.95	24.20
May	25.50	23.15	23.40
June	25.30	22.40	22.25
July	25.70	23.70	22.00
August	27.75	24.15	24.50
September	28.60	24.20	25.90
October	28.00	21.40	23.65
November	24.00	18.50	21.50
December	18.75	16.75	16.90

The average monthly prices on No. 1 cast scrap at Pittsburgh, Chicago and eastern Pennsylvania, during 1920, are as follows:

NO. 1 SCRAP

1920	Pittsburgh	Chicago	East. Pa
January	$32.50	$42.50	$35.50
February	41.50	43.25	38.55
March	41.00	42.20	40.00
April	39.60	44.10	38.00
May	39.00	42.50	38.00
June	40.00	41.75	37.00
July	38.50	41.20	37.20
August	41.50	42.00	38.75
September	42.20	39.30	39.80
October	40.75	32.75	38.00
November	38.00	27.65	34.75
December	27.50	22.10	28.90

The average monthly prices on No. 1 railroad wrought at Pittsburgh, Chicago and eastern Pennsylvania during 1920 are as follows:

NO. 1 RAILROAD WROUGHT

1920	Pittsburgh	Chicago	East. Pa
January	$29.25	$29.00	$32.75
February	34.00	30.75	32.50
March	32.50	30.00	36.29
April	31.20	30.70	34.80
May	31.00	29.50	34.00
June	29.75	28.00	33.00
July	29.20	28.10	33.10
August	31.00	28.50	33.25
September	32.00	27.50	24.10
October	21.75	22.50	29.40
November	25.25	19.50	25.25
December	19.70	17.00	20.90

Coal Tar Products Market Is Erratic

SUBSTANTIAL contracts for coal tar products placed during the latter part of 1919 and the first few months of 1920 exerted an influence that maintained the market at relatively steady prices throughout the greater part of the past year. In fact, it was not until the final month that prices showed any tendency to slump. During that period quotations on benzol, toluol, solvent naphtha and naphthalene dropped off 5 and 6 cents, and sulphate of ammonia, which had been falling off for the preceding three months or so, made almost as great a decline relatively.

Other factors tending to sustain the market, although at the same time interfering with new business, were those which so materially affected production during the first half, and also late in 1919, when the coal strike began.

This scarcity was especially noticeable in naphthalene. It was not until the final two months of the year that there was any perceptible increase in domestic supplies. Prior to that spot business had been carried on for some time almost entirely by dealers, and prices had advanced as high in the outside market as 20 cents basis f.o.b. works. This situation attracted foreign sellers, and a considerable quantity was brought in from England. However, demand dropped off sharply, and domestic production during the fall increased to such an extent that the market became fairly flooded with supplies. This forced prices downward rapidly.

While demand for phenol was fairly active up until the final two months, it was not sufficient to absorb the government stocks, which continued to be sold by the Monsanto Chemical Co., the sole agent, at the fixed price of 12 cents, government stores. Demand for solvent naphtha and benzol was strong throughout the first eight months. While inquiry for benzol declined sharply during the final four months, demand for solvent naphtha remained fairly active until near the end.

The market on sulphate of ammonia was featured during the early months by an active demand for export. However, many producers felt if all this business were booked there would be comparatively little material left for the domestic trade, and for some time booking of export orders was held up. The urgent demand coupled with the scarcity of supplies for export forced the market up to $7 per 100 pounds in double bags, New York. In April, the Japanese money panic had a great bearing on the world sulphate market. It developed that Japan had considerably overbought both from this country and Europe, and being in need of money, resold at falling prices in various markets. This weakened the domestic market considerably.

The situation was accentuated by the fact that the domestic fertilizer manufacturers who ordinarily in October and November supplement their earlier purchases, failed to do so, fearing the farmers would not buy their usual tonnage owing to the money stringency. As the year ended, no inquiry for either domestic or foreign consumption was lacking and prices were easing off.

Coal Tar Products Prices in 1920

PRODUCERS' PRICES F. O. B. WORKS

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec
Benzol	$0.29	$0.29	$0.30	$0.31	$0.33	$0.33	$0.38	$0.38	$0.38	$0.38	$0.38	$0 33
Toluol	.30	.30	.30	.32	.34	.34	.38	.38	.38	.38	.38	.33
Solvent naphtha	.25	.25	.28	.30	.30	.28	.32	.32	.32	.32	.32	.315
* Phenol	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12	.12
Naphthalene, flakes	.075	.08	.085	.105	.105	N	N	N	N	N	.145	.095
Napthalene, balls	.09	.10	.10	.10	.10	N	N	N	N	N	.155	.105
Spot sulphate of ammonia	4.00	4.00	4.55	4.55	4.55	4.55	4.55	4.80	4.80	4.25	3.75	3.38
Future sulphate of ammonia	N	N	N	4.55	4.55	4.55	4.55	4.55	4.55	N	N	N

N—Nominal

* Government fixed price, f. o. b. government stores

In The English Black Country

European Market Reviews for 1920

Reports by The Iron Trade Review
Staff Correspondents
Covering.

Great Britain
France
Italy
Belgium
Germany
Austria
Czecho-Slovakia

European Iron and Steel Prices in 1920

British Prices in Pounds Sterling

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
SEMIFINISHED STEEL—												
Billets, soft steel	17.10.0	21. 0.0	23.10.0	26. 0.0	26. 0.0	26.10.0	25. 0.0	23.10.0	22.10.0	21.10.0	20. 0.0	18. 0.0
Sheet bars	17.10.0	22.10.0	27.10.0	32. 0.0	31.10.0	30. 0.0	27.10.0	24. 0.0	23. 0.0	21.10.0	20. 0.0	18.10.0
Wire rods	....	....	....	....	....	....	....	35. 0.0	30. 0.0	30. 0.0	27. 0.0	27. 0.0
FINISHED STEEL—												
Steel bars, England, 5-8 to 3 inch	21.15.0	23.10.0	28.10.0	28.10.0	28.10.0	32. 0.0	32. 0.0	32. 0.0	32. 0.0	31. 0.0	27. 0.0	22. 0.0
Ship plates	21.10.0	23.10.0	23.10.0	23.10.0	25. 0.0	25. 0.0	23.10.0	25.10.0	26. 0.0	30. 0.0	25. 0.0	22. 0.0
Ship plates, Scotland	21.10.0	23.10.0	23.10.0	26.10.0	28. 5.0	28. 5.0	27.10.0	25. 0.0	28. 0.0	30. 0.	25. 0.0	22. 0.0
Beams, England	18. 5.0	19.10.0	20.10.0	22.10.0	24.10.0	24. 0.0	23. 0.0	24. 0.0	25. 0.0	25. 0.0	24. 0.0	22. 0.0
Beams, Scotland	18. 5.0	19.10.0	21.10.0	23.10.0	27. 0.0	28. 0.0	27. 0.0	28. 0.0	30. 0.0	28. 0.0	24. 0.0	22. 0.0
Sheets, black, 24 gage	29. 0.0	40. 0.0	40. 0.0	42. 0.0	45. 0.0	45. 0.0	44. 0.0	40. 0.0	37. 0.0	36. 0.0	34.10.0	31. 0.0
Sheets, galvanized	45. 0.0	50. 0.0	51. 0.0	56. 0.0	56. 0.0	54. 0.0	53. 0.0	49. 0.0	44. 0.0	40. 0.0	37.10.0	34. 0.0
Rails, 60 pounds and over	17.10.0	18.15.0	19.15.0	21. 0.0	23. 0.0	23. 0.0	23. 0.0	25. 0.0	25. 0.0	25. 0.0	25. 0.0	25. 0.0
Tinplates, base box 108 pounds	2.12.0	3.10.0	3.12.0	3.17.0	3.15.0	3.12.0	3.10.0	2.19.6	2.18.0	2.14.0	2. 2.0	2. 1.0
Steel hoops	....	....	....	....	....	....	....	36. 0.0	36. 0.0	36.10.0	34.10.0	33. 0.0
PIG IRON—												
Hematite, East Coast mixed numbers	10. 0.0	11. 0.0	11. 0.0	13. 0.0	13. 0.0	13. 0.0	13. 0.0	13. 0.0	13. 5.0	13. 0.0	13. 0.0	13. 0.0
Hematite, West Coast mixed numbers	....	....	....	....	....	....	....	14.15.0	14.15.0	14.15.0	14.15.0	14.15.0
Middlesborough basic	8. 5.0	9. 0.0	9. 5.0	10.10.0	10.10.0	11. 7.6	11. 7.6	11. 7.6	11.15.0	11.15.0	11.15.0	11.15.0
Middlesborough, No. 3	8. 0.0	8.15.0	8.15.0	10. 0.0	10. 0.0	10.17.6	10.17.6	10.17.6	11. 5.0	11. 5.0	11. 5.0	11. 5.0
No. 3 Foundry, Derby, Leicester and Nottinghamshire	9. 5.0	10. 2.6	10. 5.0	11. 0.0	11. 0.0	12.10.0	13. 2.6	13.17.6	14. 7.6	14. 5.0	14. 0.0	13.10.0
No. 3 Foundry, Northamptonshire	8.12.6	9.12.6	9.12.6	9.19.6	10. 7.6	11.12.6	12. 0.0	12. 5.0	12. 5.0	12.15.0	12. 7.6	12. 2.6
No. 3 Foundry, Staffordshire	9.12.6	10.12.6	10.12.6	11.11.0	11.10.0	12. 7.6	12. 7.6	13. 0.0	13.12.6	14.12.6	13.17.6	13.17.6
No. 3, Scotch foundry	9.15.0	10.10.0	11.11.0	12. 0.0	12.10.0	13.15.0	13. 5.0	13.10.0	13.10.0	13.10.0	13.10.0	13.10.0
Ferromanganese, 80 per cent	27. 0.0	30. 0.0	30. 0.0	32.10.0	37. 0.0	37. 0.0	37. 0.0	37. 0.0	37. 0.0	37. 0.0	37. 0.0	35. 0.0
COKE—												
Furnace, Yorkshire	....	2.13.6	2.13.6	2.18.6	2.18.6	3. 5.3	3. 5.3	3. 5.9	3. 5.9	3. 5.9	3. 5.9	3. 5.9
Foundry, Yorkshire	....	3. 3.0	3. 6.0	3.11.0	3.11.0	4. 0.0	4. 0.0	4. 5.0	4. 5.0	4. 5.0	4. 5.0	4. 5.0

German Prices in Marks—Per Metric Ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
PIG IRON—												
Hematite	1718	2210	2215	2338	2350	2150	2150	1910	1910	1910	1910	1910
No. 3 Foundry	1323	1625	1665	1775	1789	1739	1739	1659	1659	1659	1659	1659
Siegerland basic	977	1285	1324	1489	1683	1626	1626	1610	1610	1610	1610	1610
Specular iron	1047	1360	1400	1570	1691	1704	1704	1704	1704	1704	1704	7104
SEMIFINISHED STEEL—												
Ingots	1430	2190	2255	2255	2650	2435	2435	2140	2140	2140	1770	1770
Blooms	1465	2225	2290	2290	2290	2655	2655	2260	2260	2260	1895	1895
Billets	1500	2260	2325	2325	3125	2725	2725	2365	2365	2365	1995	1995
Slabs	1505	2265	2330	2330	3200	2790	2790	2410	2410	2410	2040	2040
FINISHED STEEL—												
Beams	1715	2620	2685	2772	3620	3105	3105	2740	2740	2740	2340	2340
Government rails	2600 to 2650	2750 to 2800	2815 to 2860	....	3772	3320	3320	2950	2950	2950	2550	2550
Shapes	1715	2620	2685	2772	3620	3105	3105	2740	2740	2740	2340	2340
Bars, rounds and rods	1745	2600	2650	2650	3650	3200	3200	2840	2840	2840	2440	2440
Hoops	1925	2860	2900	2900	4050	3585	3585	3185	3185	3185	2740	2740
Plates over 5 mm	2235	3415	3435	3435	4700	4040	4040	3595	3595	3595	3090	3090
Plates over 3 mm	2520	3865	3870	3870	5535	4775	4775	4060	4060	4060	3320	3360
Plates under 3 mm	2585	3935	3935	3935	5600	4840	4840	4195	4195	4195	3475	3475
Wire rods	2000	3120	3150	3150	4150	3585	3585	3160	3160	3160	2720	2720
Drawn wire	2450	4000	4000	4000	5000	4400	4400	3900	3900	3900	3350	3350
Galvanized wire	2950	4800	4800	4800	5800	5100	5100	4550	4550	4550	4000	4000
Wire nails	2800	4700	4700	4700	5750	5150	5150	4650	4650	4650	4100	4100

French Prices in Francs—Per Metric Ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Foundry pig iron, 3 per cent silicon	334	400	450	525	590	645	600	600	600	600	450	450
Hematite pig iron, Lorraine	430	520	520	700	840	840	855	855	855	855	705	705
Billets	....	650	650	725	945	945	973	973	973	973	773	773
Plates	1050	1230	1360	1490	1580	1840	1840	1840	1840	1840	1620	1620
Shapes	950	1100	1150	1270	1400	1450	1450	1450	1450	1400	1150	1150
Merchant bars	1100	1150	1200	1300	1450	1450	1450	1450	1450	1450	1200	1200
Furnace coke	....	....	....	210	275	275	275	275	275	175	175	175

Belgian Prices in Francs—Per Metric Ton

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Foundry pig iron, 3 per cent silicon	530	625	625	800	850	850	750	650	625	540	480	500
Basic-bessemer pig	....	....	....	800	850	875	775	625	575	575	465	475
Billets	....	700	700	1200	1200	1250	975	960	815	750	675	650
Plates	1100	1200	1300	1600	1600	1650	1550	1450	1350	1250	1250	1150
Shapes	875	900	1000	1500	1550	1550	1350	1150	1000	950	850	800
Merchant bars	850	900	1000	1400	1500	1500	1300	1150	1050	950	850	825

Competition Restored in Europe

Consumers Scramble for Tonnage Ends and Old World Producers Commence Fight for Business—Exchange Factor Becomes Tremendous Handicap to American Exporters—Europe Increases Iron and Steel Production

HY H. COLE ESTEP
European Manager, The Iron Trade Review

GERMANY again is selling iron and steel products in South America. Belgium has upset the British markets and is doing business in Africa. French steel is going into Syria. Even Austria, out of her penury, is exporting to Italy. The new year finds international competition everywhere restored, for the first time since those far-off days when German guns smashed the forts of Liege. The curtain has been rung down on the first act of the postwar commercial drama, and the year 1921 will witness a new scene, the commencement of the battle for business. In this struggle, with the world for its field, how will America fare? It is from this point of view, of consideration for American interests, that we propose to approach a study of the position of the European iron and steel industry at the beginning of the third year after the war.

Our observations must of necessity be in the nature of snapshots of a flowing stream, for events are still moving swiftly in the old world's iron and steel business, and a state of equilibrium has by no means been reached. The after-the-war boiling down process appears far from complete and there are still many eddies and cross currents in world trade. These anomalies are due to bad distribution, and they center mainly around Germany. With marks worth less than 1½ cents each, we find American ship plates going to Germany in fairly large quantities, while Germany at the same time is selling her own plates to Denmark in exchange for nearby supplies of food. Again Germany is exporting huge quantities of coal to Switzerland, France and Italy, and at the same time buying 20,000 tons a month from the United States at 2000 marks a ton. More recently, we find American export agencies, with headquarters in New York and presumably established connections with American mills, buying steel in Europe for shipment to their customers in South America and the Far East.

The foregoing incidents are cited to show the tremendous displacement of the ordinary channels of trade, which exists throughout the world, due to three factors, the elimination of Russia from the world's commerce, the collapse of production in Central Europe, and the consequent chaos in international exchange. The high value of our money is a millstone around our neck. This is clearly evident by examining the accompanying price diagrams. At the beginning of 1920 a pound sterling was worth $3.80 and basic pig iron was $31.35 in Middlesborough, England, and $37 in Pittsburgh; billets were correspondingty $66.50 and $50. By the end of the year sterling was down to under $3.50 and our iron and steel trading position relatively unchanged, with American basic pig at $35 and English at $39.95, billets being respectively $50 and $63. On the continent, with the exception of Spain and Italy, the price comparisons are much more unfavorable to the American producer. Generally speaking, and taking into account the ocean freight rates of from $6 to $18 a ton, the recent price declines in the United States have not improved our international position; prices abroad have declined in an almost parallel manner, and exchanges generally have gone strongly against us.

The rate of exchange is shutting the United States out of the European markets. It is the biggest single deterrent to the further development of our export trade in iron and steel. Its importance cannot be overestimated. And the end is not yet. A year ago sterling exchange stood at 79 per cent of par in New York; today it is about 72 per cent. Francs have dropped during the year from 49 to 36 per cent of par; Italian lire from 40 to 17 per cent; German marks from 10 per cent to 6 per cent. The neutrals have not escaped. Spanish pesetas are now 69 per cent of par in New York; Dutch florins, 75 per cent; and Swiss francs, 81 per cent. The real tragedies, from the exporter's standpoint, are in Central Europe where Austrian crowns are worth about 1 cent on the dollar, Hungarian about the same, and Polish marks 0.9 per cent of par!

With exchange conditions as they are, Europe is buying American iron and steel products, not because it is commercially profitable, but from sheer necessity. Under these conditions it is pertinent to examine European production rather carefully. The entire situation is shown at a glance in the accompanying table. Last year Europe produced 20,735,000 tons of pig iron and 23,315,000 tons of steel. This represents only about 55 per cent of her prewar output there being only one country in the Old World—Great Britain, which is making more iron and steel than before the war, while the collapses in Germany, Austria and Russia have been simply colossal. But although less spectacular it is more important to note that Europe's produc-

Europe's Iron and Steel Output

LAST YEAR, THE YEAR BEFORE, AND BEFORE THE WAR

Figures for 1920, and in some cases for 1919, estimated gross tons

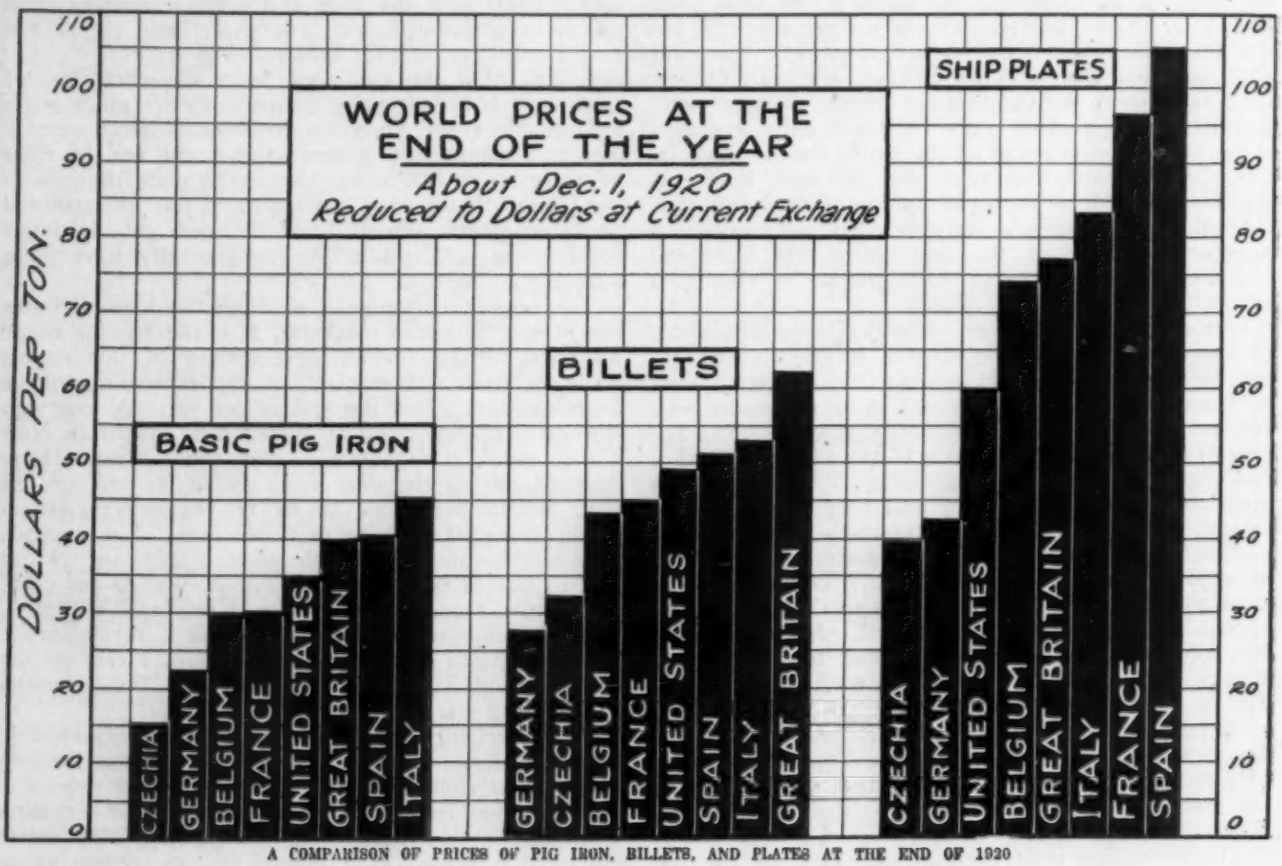
	PIG IRON			STEEL INGOTS		
	1920	1919	1913	1920	1919	1913
Great Britain	8,305,000	7,393,000	10,260,000	9,378,500	7,894,000	7,664,000
France	3,000,000	2,412,000	5 126,000	3,000,000	2 151.000	4.614,000
Germany	7,000,000	6,192,000	19,000,000	8,000,000	7,644,000	18,631,000
Belgium	750,000	200,000	2,428,000	800,000	300,000	2 428,000
Italy	450,000	309,000	420,000	800,000	700.000	918,000
Spain	350,000	300,000	350,000	400,000	400,000	300,000
Sweden	500,000	480,000	718,000	400,000	460,000	582,000
Czechia	300,000	100,000	....	400,000	100,000	....
Austria	80,000	40,000	2,343,000	137,000	50,000	2,584,000
Russia	Nil	Nil	4,484,000	Nil	Nil	4,760,000
Total Europe	20,735,000	17,426,000	45,129,000	23,315,500	19,699 000	42,481,000
United States	36,300,000	30,578,000	30,966,000	41,860,000	34,000.000	31,301 000

tion gained about 26 per cent in 1920 over 1919. In spite of the war's destruction, strikes, revolutions, transportation tieups, and fuel shortage, Europe is steadily making headway toward normal conditions and is daily becoming more able to take care of her own requirements and to export.

Although the situation is temporarily difficult, in the long run, owing to our anomalous exchange position, Europe's recovery in production and actual entry on an extensive basis into the world's export iron and steel trade is going to benefit American industry, rather than the reverse. At present the American iron and steel business, in its export capacity, is like a giant in chains. We need normal conditions to exert our strength, conditions wherein values are dependent on American production and efficiency and not on the markets for foreign currencies. Our great strength lies in our dominating position. We are producing twice as much steel as all Europe, and if exchanges were normal our prices would be by far the lowest. Almost the whole hope for the future of our export trade lies in the righting of the international banking situation, and this, almost everyone is agreed, can only be done by the recovery of production and thrift in Europe.

The two big factors which are holding up European production are coal and labor—or rather the lack of both. They are twin problems. A recent careful estimate shows that the world is now running short in coal production to the tune of 69,000,000 tons a year. There are only six countries with a surplus for export, and of these, two, the United States and Great Britain, together hold 80 per cent of the available supplies. The question of more coal is almost entirely one of improved labor efficiency. Meanwhile the European iron and steel industries are starving for fuel. Lack of coke accounts for the present pitiful productive record of the former Austro-Hungarian empire, where only about 600,000 tons of steel were produced in 1920 compared with 2,584,000 tons before the war. British steel production is still 3,000,000 tons a year short of capacity, due largely to the same cause. Little Belgium, which has amazed the world by her plucky recovery, could double her steel output, while France could triple hers, had she the necessary *carbon*.

Fortunately some headway is being made. Germany and England, the two biggest producers outside of the United States, are now doing better. German coal production during 1920 increased from 10,329,000 tons a month to 11,550,000 tons per month.



A COMPARISON OF PRICES OF PIG IRON, BILLETS, AND PLATES AT THE END OF 1920

The very latest figures from British mines indicate that a rate of 260,000,000 tons a year was achieved in the third week after the strike, against a rate of only 246,000,000 tons during the first quarter of last year. But unless England can do even better than this, the 14 new blast furnaces now building in the United Kingdom will be of little avail.

The European iron and steel industry is suffering all around from lack of fuel, and the shortage of coal may in turn be traced back directly to the domination of closed shop unionism in the iron, steel, and coal producing industries in the Old World.

After all is said and done, perhaps America's greatest source of strength in the after-the-war struggle for business which is now opening on the world, is found in her free labor conditions, and in the determination of the leaders of the American iron, steel, and engineering industries to maintain the open shop at all hazards.

British Industry in Transition

Prices Actively Are Liquidating as Year Ends—Commercial Conditions and Labor Troubles Prevent Increased Plant Capacity Being Fully Utilized—Struggle To Maintain Export Trade—Workmen Now Less Unruly

BY JOSEPH HORTON
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IN Great Britain the general industrial position has changed completely during the past twelve months. The close of the year finds the country descending the slope of depression at a somewhat acute angle, with a disagreeable general feeling that conditions will have to be a good deal worse before they are better. But on the whole, the year has been one of great activity and high prices. The oldest veteran in the iron and steel industry cannot recall a time like the early summer when galvanized sheets touched £56, steel bars £32, black sheets £45, a ton with an insistent demand, and the manufacturer still in a dominating position.

The financial records show that with regard to trade generally the year has been one of great industrial enterprise, 1920 exceeding all previous records as to the number of companies established and their total capital. At the close of the year, the principal iron and steel works, like the Ebbw Vale company, Hadfields, Ltd., Guest, Keen & Nettlefolds, etc., either were issuing new capital or had recently done so. The month of May was signalized by the announcement of the acquisition of steel, coal and shipping interests in Great Britain and Canada, by a combine aggregating a capital value of £100,000,000. Several of the best known British steelmakers and shipbuilders, such as Lord Furness, Sir William Beardmore, the late Henry Steel, and Benjamin Talbot figured in this deal, the object of which is to utilize Canadian resources in co-operation with British plants for economical steel and ship production on a large scale. It is understood this enterprise is still going forward though little has since been heard of it. Part of this capital raising movement has been due to the action of the banks in keeping a close hand on overdrafts, which has nipped in the bud many a promising enterprise. On the whole, the bank policy has been commended, as tending to produce a healthier state of matters, and put a curb upon mushroom enterprises.

The general tightness of money has had its effect upon commodities, most of which are noticeably cheaper, particularly boots and clothing, and some classes of food, a kind of relief generally welcomed.

Toward the end of the year there was a significant increase in unemployment. This experience has brought a shock to workpeople generally, who have been enjoying for several years past an unexampled prosperity and an abundance of money, a great deal of which has been lavishly expended on luxuries. The industrial classes now realize only too vividly that they can no longer claim the dictatorial position they have so long held, although they are reluctant to accept the lower wages which must inevitably follow the general decrease in values. It has been recognized for some time that, with the inflated prices, the position is uneconomic and sooner or later a collapse must come. By a large body of public opinion, the reaction is welcomed.

Bitter Against Strikers

The feeling of insecurity generally prevailed for some time before the coal strike in October. This largely accounted for the general feeling of public bitterness against the coal miners in attempting to force further concessions at a time when every other class of the community realized that the tide had turned. No strike was ever so unpopular, and the public hostility alone would unquestionably have sufficed to defeat the miners if a settlement had not been reached by negotiation. The miners' strike, however, applied a severe test under which the artificial remnant of prosperity broke completely. On the whole, the country has borne the strain fairly well, but the movement has a long way yet to go, and it is too early to predict either its extent or its results. But some little wreckage in the way of liquidated companies already is floating to the surface, and millions of money have been lost by shareholders investing in ambitious companies, particularly motor companies seeking to emulate American achievements in the way of mass production.

Turning now to iron and steel production, it is seen from the statistics issued by the National Federation of Iron and Steel Manufacturers that some progress has been made in increased production. The total output of pig iron up to the end of October was 6,922,000 tons, as compared with 6,142,000 tons in 1919. Under the head of steel ingots and castings the 10 month's production aggregated 7,805,000 tons, as against 6,507,000 tons last year. It will be seen that the growth in pig iron production was on a much smaller scale than that of steel, although under neither head, had the expectations of the industrial chiefs of the industry been realized. In March, 1919, Benjamin Talbot stated to the coal commission that the extensions then in progress would give a productive capacity of 12,000,000 tons of ingots per annum. Many of these extensions have since been completed, although all are not yet in operation.

The inadequacy of British pig iron capacity is a disagreeable fact which has frequently been considered by leading steel manufacturers. Up to date, however, no sufficient steps have been taken to bring blast furnace capacity up to somewhere near the requirements of the country's enlarged steelmaking plant. At present, it is impossible to go into exact figures. But in a general way, it may be stated that fairly substantial progress has been made, although the achievements have been far below the requirements. Perhaps the most noteworthy blast furnace addition has been the large unit already in operation at the Ebbw Vale works, with a capacity of 3,000 tons per week. A second furnace of similar capacity has been completed at Ebbw Vale, but will not be started until the question of prices is much more stable. Two modern furnaces have been built also by Baldwins Ltd., at Margam, Port Talbot, in South Wales, with a united capacity of 4,000 tons of basic pig iron weekly, using native Oxfordshire ores. These furnaces, also, are not yet in operation. It is understood that Steel, Peech & Tozer also have in contemplation the erection of blast furnaces adjacent to their large new steel works at Templeborough, but work on these has not yet been commenced.

Among other pig iron making interests, the North Lincolnshire Iron Co., Scunthorpe, now has in operation a

furnace which has been fitted up with up-to-date mechanical charging apparatus. The Sheepbridge Coal & Iron Co., Ltd., is building a large new blast furnace on modern lines, though it will be some time before it is ready for operation. The Shotts Iron Co., Ltd., of Edinburgh, is extending its plant to increase by 150,000 tons per annum its output of pig iron and the company will be producing within six months. Generally speaking, the interests concerned have done their best to increase production as far as present plants will enable them to do so. At the end of September, the number of blast furnaces in operation in Great Britain was 270, comprising 209 in England and Wales and 61 in Scotland.

In new steelmaking plants, great progress has been made during the year, although several of the modern mills are not yet in operation, chiefly because at existing prices international business is almost an impossibility. Details regarding the most important of these works extensions already have been presented in THE IRON TRADE REVIEW, and others will follow. So far as labor is concerned, the year has been one of steady and large increases in wages. For the first nine months, the men had regular employment, and it is remarkable that as recently as June last, predictions of a slump were scoffed at as the mere inventions of croakers. In the previous month, Sir Robert Horne, president of the board of trade, confidently declared that the boom would continue for considerable time. Nobody doubts now that the period of high wages has passed, and that the movement will be steadily downward. The turning point appears to have been reached in June, when Belgian competition first appeared. Billets then were offered at British ports at £25 per ton and were sold freely. At that time Welsh sheet bars were selling at £30. No doubt, the prevalent high prices accounted for the fact that America then was putting steel bars into England at £30 per ton. Generally speaking, however, and due chiefly to the rate of exchange, American competition throughout the year has been almost negligible.

Belgium, on the other hand, with a rate of exchange of 54 francs to the pound, has nearly swept the British market, as far as prices are concerned, although her contributions have been relatively small in tonnage. Compared with the offer of £25 in June for billets and sheet bars, by the end of November she was exporting to Britain at £10.10.0, f.o.b. Antwerp, and every day appears to bring lower quotations. There is an uneasy feeling that Belgium is merely a kind of covering intermediary for Germany. No doubt is entertained that the first formidable attack upon the iron skelp business, in which for something like nine months the Staffordshire iron masters held a monopoly, came from Germany, in October. When skelp, described as continental, was imported in large quantities at £29 delivered, against £35, the British figure. Germany in prewar days was a very large exporter of cheap iron and steel skelp to Great Britain, and, before the war, was the principal competitor with British tube makers in the world's open markets.

Shipbuilding continues a large consumer of steel, and so far production has been fairly well maintained. At the end of September, the total tonnage of merchant shipping being constructed in the United Kingdom was 3,731,098 tons, an increase of 153,000 tons as compared with June, 1920, and of 914,000 tons as compared with a year ago. The total tonnage building abroad was 3,834,073 tons. There is a general agreement that these figures do not quite represent the actual condition of the industry. Numerous cancellations have taken place, and, in view of the large fall in freights, ship owners no longer are disposed to pay the enormous prices for the building of ships which were paid during the past two years. It seems impossible that anything like the immediate postwar activity of the shipyards can be maintained during the coming year.

The general economic position is baffling and unsatisfactory. At the beginning of October, the price of food, clothing, fuel and light, etc., was 164 per cent above the level of July, 1914. The increase for food alone was 170 per cent. A great deal depends in the solution of difficulties on the future prices of necessaries. There is a general expectation that these will be reduced. There is talk of lower prices for bread and other necessaries but these have not yet materialized, and the trade position is, therefore, in very much of an impasse. Employers say they cannot possibly compete with foreign nations, or lower the prices of their productions, unless the cost of production is materially decreased. The principal elements in these costs are, of course, fuel and labor.

The workpeople say that they cannot accept lower wages, without a substantial reduction in the cost of living. So far, the iron and steel trades as already suggested have stood very well the strain of reduced selling values, and the largest steel companies have not hesitated to pay fairly substantial interim dividends. Their unanimity, however, in seeking fresh capital at as high as 10 per cent, tells its own story of financial strain. It would appear that some months must elapse before anything like stable prices are reached, and, with the present costs of production, the British steelmakers cannot compete by several pounds per ton with the prices at which foreign steel is coming into this country. As wages, generally, are regulated by sliding scales, some months must elapse before this slow-moving machinery brings down wages, in the wake of falling prices.

It is significant that some of the most modern plants built for quantity production have either not been started, or already have become idle for lack of orders. A notable example of this is the wire rod mill started up in the early part of the year by Steel, Peech & Tozer, which lost much time in the autumn for want of orders. The Margam plant, in South Wales, has also not yet started for lack of the requisite demand. While the necessity of mass production is recognized, it has become an aphorism that this method of production is useless, unless orders also

British Exports Compared

Gross tons of 2240 pounds

	Ten months ended October		
	1913	1919	1920
Pig iron	950,447	272,797	535,775
Iron rods, bars, angles	123,925	29,467	49,054
Steel rods, bars, angles	217,090	211,123	318,863
Hoops and strips	37,787	41,581	47,612
Plates and sheets, not under 1-8 inch thick	116,160	205,598	168,219
Plates and black plates, under 1-8 inch thick	58,213	114,838	123,746
Black plates	59,000	24,108	32,737
Galvanized sheets	631,084	131,340	373,192
Tinned plates and sheets	411,764	236,513	302,129
Tubes, cast	198,619	45,954	82,457
Tubes, wrought	135,762	78,586	101,773
Steel rails	425,003	98,105	111,048
Wire	50,068	20,500	55,362
Wire manufactures	46,806	24,793	44,605
Cast iron manufactures	68,159	17,237	21,582
Anchors, cables, chains, etc	29,046	22,007	26,147
Hollow-ware	31,419	6,727	19,061
Other manufactures of iron and steel	178,959	52,271	96,105

are received in sufficiently large volume.

It is rather remarkable that pig iron, which everybody recognizes to be the great key to the iron and steel trade, at this time, has not shared to any extent in the general slump. This is undoubtedly due to the chronic scarcity of this raw material. The blast furnace operations really are not yet in want of business, and, as they cannot see their way to incur the risk of expensive production unless a big volume of business is in sight, some of the best and most modern furnaces in the kingdom, with capacities far beyond anything previously achieved, are likely to be idle for some months to come.

The pig iron makers say they cannot sell at lower prices, in view of the present cost of production. The northeastern makers have had to ration supplies to Scotland, sending tonnages considerably below what the Scotch steelmakers would be glad to buy. Similarly, the large export business formerly done in pig iron practically has been in suspense for months past, as the combined result of short production and high prices.

The general falling off in the exports of pig iron may be inferred from the accompanying table for 10 months ended October, which shows a total shipment of 535,775 tons, as compared with 950,447 in 1913. At present there seems no possibility of recovering the old position in regard to the British export trade. It is unnecessary to go into detail with regard to other products. The figures speak for themselves. But such items as galvanized sheets, steel rails, rods, bars and angles are highly significant. A large shrinkage equally of production and foreign business seems inevitable for some months to come.

A remarkable feature of the year has been what may be called a widening gap between puddled iron and steel. Iron occupies increasingly a sphere of its own. Time after time it has maintained its prices when steel was fluctuating, and not until the end of November did the first sign of a break in finished iron prices appear. In spite of obsolete plants, makers practically made their own terms, not only maintaining their high price of £30 10s for finished bars, but a premium as well. They have been assisted in this by the very restricted output. The iron trade is not suited to the 8-hour day, which the government, at the instigation of the workmen, pressed upon the trade. There are not workmen enough to run a triple shift. The 8-hour system is also very wasteful in fuel, and, with the bad coal now being turned out of the mines the puddlers cannot possibly get out a satisfactory number of heats by working to a strict time-table. In the early part of the year, large foreign orders were turned back through sheer inability to supply the material. But now, it is recognized that this trade has sustained material injury, and may be long in recovering its old place, from the international point of view.

The tin plate industry also is crippled by unprecedented wages and costly production. While exports have shown some recovery on last year, they are still far below those of 1913. The latest statistics available are for September, when there were 401 tin plate mills in operation, an increase of 53 on a year ago, and 105 steel sheet mills, an increase of 19. The workpeople did their best some time ago to introduce a 6-hour shift, the idea being to run four shifts in 24 hours, but eventually they were persuaded to drop this highly ambitious program, and the matter was settled on the basis of additional help in the way of assistance to the skilled workmen. Galvanized sheets also are in the doldrums, with falling prices and small production.

It cannot be said that the present slump has found manufacturers altogether unprepared. The year has been unique in the number of great amalgamations, many of the large steel concerns having made themselves self-contained by the absorption of firms producing material for steel manufacture.

British Foreign Trade in Iron and Steel

British Exports in Gross Tons for 1920

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
Pig iron	51,356	67,537	65,380	61,615	61,389	53,015	63,964	31,162	43,359	37,000
Iron bars, rods, angles, etc.	4,279	3,096	6,491	4,140	5,471	5,265	6,756	4,376	4,836	4,344
Steel bars, rods, angles, etc	25,419	18,055	28,907	27,825	36,898	34,292	48,818	37,988	28,401	32,260
Hoops and strips	5,670	2,154	3,865	3,638	4,700	4,802	6,774	5,524	6,117	4,368
Plates and sheets, not under 1-8 inch thick	13,678	16,476	15,532	12,393	19,621	14,882	22,787	15,602	15,757	21,491
Plates and black sheets, under 1-8 inch thick	11,597	8,525	15,236	13,160	19,266	11,014	12,607	10,338	9,959	12,044
Black plates	5,147	3,666	2,931	2,261	3,846	3,167	2,225	2,299	1,893	4,300
Galvanized sheets	35,162	24,757	39,927	36,206	41,761	45,826	51,214	40,042	29,101	29,196
Tinned plates and sheets	31,591	21,751	25,357	32,951	36,480	32,756	32,616	31,880	20,543	36,204
Tubes, cast	7,701	4,078	5,791	8,206	10,571	7,193	12,104	11,879	7,636	7,298
Tubes, wrought	8,643	7,453	9,697	8,740	11,253	11,854	12,638	11,227	9,001	11,265
Wire	4,720	4,963	3,745	4,596	5,270	6,397	8,308	5,951	5,110	6,401
Wire manufactures	3,800	4,147	4,628	4,626	4,783	4,119	5,569	4,428	4,205	4,210
Steel rails	6,757	5,085	10,998	7,422	11,810	9,481	24,096	9,354	14,409	11,636
Anchors, cables, etc.	3,139	1,818	2,327	2,073	2,214	3,041	3,203	2,925	2,669	2,738
Hollow-ware	1,648	1,353	1,354	1,885	2,012	1,892	2,520	2,485	1,860	2,052
Other manufactures of iron and steel	8,875	6,654	11,816	10,169	9,699	8,147	9,353	11,242	9,678	10,472
Cast iron manufactures	2,860	2,466	2,658	1,222	2,102	2,030	2,607	1,550	1,390	2,497

British Imports in Gross Tons for 1920

	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.
Pig iron, forge and foundry	1,162	1,406	1,495	1,407	3,397	3,278	2,064	2,582	2,944	2,579
Pig iron, bessemer	....	175	350	....	1,050	1,245	1,241	2,456	....	1,865
Pig iron, basic	19,926	13,148	15,773	9,809	11,207	15,346	4,511	9,593	5,290	18,300
Ferroalloys	533	771	1,190	1,018	3,446	1,859	2,164	1,379	1,412	1,078
Blooms, billets and slabs	16,059	14,237	15,248	17,042	19,460	29,115	23,858	30,572	22,101	23,749
Iron bars, rods, angles, etc.	7,079	5,038	3,966	7,487	3,782	5,204	5,216	8,286	9,499	11,426
Steel bars, rods, angles, etc	2,222	2,461	2,955	1,379	3,977	2,443	4,291	1,775	2,865	5,636
Steel girders, beams, etc	51	70	....	215	671	1,672	306	648	760	1,029
Hoops and strip	3,244	646	1,913	2,557	952	516	307	709	2,101	5,876
Plates and sheets	2,956	11,384	10,247	5,026	6,157	8,324	13,841	11,941	27,063	29,433
Tubes, cast	201	506	349	244	195	98	364	539	600	905
Tubes, wrought	1,554	821	745	734	755	939	1,231	1,968	1,274	1,115
Wire rods	994	5,026	2,776	4,626	2,561	6,982	7,021	3,188	5,247	5,328
Wire	705	1,125	1,291	1,646	1,558	2,292	2,084	3,445	4,264	3,908
Wire manufactures	1,630	2,371	1,767	3,544	3,903	4,913	3,862	5,222	4,145	5,244
Manufactures of iron and steel	1,323	548	499	1,330	510	927	1,166	913	1,647	1,640

France Is Steadily Reorganizing

Production, Although Still Far Below the Prewar Level, Shows a 25 Per Cent Gain Over 1919 — Fuel Shortage Proves a Big Handicap — Country Is Exporting More Steel Than Before the War

BY FRANCIS MILTOUN

French Correspondent, The Iron Trade Review

TAKING the price barometer of pig iron as a basis, the French iron and steel industry may be said to have begun its material progress toward a future prosperity only in mid-October. Then, for the first time since the early part of the year, this product fell below 500 francs per metric ton. A fortnight previously metallurgical coke had dropped, by a sort of quasigovernmental decree, from 275 francs a ton to 175 francs. Semi-finished and finished iron and steel followed. This result was brought about by a government appeal to manufacturers to meet the issue presented by existing conditions, the government itself undertaking the responsibility for coke supply and the new price which was suggested. How favorable this new coke price is, plainly is shown by reducing it to dollars at current exchange of 17.29 francs, which equals $11.70 the ton. Small stocks of fuel have now begun to accumulate for the first time since the armistice.

The initial impetus to this movement was given by the fulfilling of the German agreement, arrived at in Spa in August, whereby France was to be assured of something more than 1,500,000 tons of fuel from Germany a month, including a fair proportion of coking coal and coke. This agreement is to be abrogated in January, 1921, in favor of some other working arrangement, but as a paramount necessity, the French iron and steel industry must continue to receive this German coal, or another period of marking time will set in.

France's coal needs have risen from something like 60,000,000 tons in 1913 to 90,000,000 tons in the present year. These needs at best are being met only to the extent of 70 per cent.

Are Dependent Upon Each Other

The position of Germany is that its industry must bring its iron ore from France, Spain and Sweden; and that France must bring coal largely from Germany in order to stimulate its own metallurgical industries. Hence the game of iron and coal politics which is being played so strenuously between the two powers.

French iron and steel prices may be considered as stabilized only temporarily, although in some quarters it is believed no further drop can be looked for before March or April. Then a surplus of finished products, even plates and sheets, which up to now have been entirely lacking in the warehouses, should begin to accumulate in quantities sufficient to make the market more favorable to the buyer.

Agree to Stabilize Prices

Pig iron prices reached their lowest figure during the last six months of 1920 on Nov. 1, but on Nov. 10, an agreement was reached with Belgium and Luxemburg operators whereby foundry iron was to be controlled internationally at 500 francs a ton by a tripartite stabilizing of the respective outputs of the three countries concerned. This involved a rise on Belgian pig iron, considering the variation in the values of the Belgian and French francs of 25 francs or more per ton. Belgian producers for the moment agreed and took their additional profits. The arrangement is "to be subject to revision from time to time in case of important variations in the prices of raw materials," so after all this is but a *modus vivendi* of the time being, though it may give France a breathing spell awaiting the time when the matter of provisioning in coal and coke shall be definitely settled.

French Output in 1919

	Metric Tons
Pig iron	2,412,149
Basic bessemer ingots	1,012,916
Basic open-hearth ingots	1,065,166
Acid bessemer ingots	48,682
Crucible and electric ingots	59,496
Rails	147,295
Plates and sheets	241,776
Shapes	743,195
Wheels and tires	23,102
Steel castings	44,893
Forgings	34,262

The bogey of a financial crisis is not hanging over the French iron and steel business, though it has retarded its development in the past. Between now and spring the leveling-up influence should bring about effective results. It is believed in many quarters that prices must decline all along the line. With living costs at a little more than 350 per cent of what they were before the war, the position of the French coal miners in November in asking for a 500 per cent increase over prewar wages was untenable, as they soon found out.

The 8-hour day, increased wage bill and high cost of raw material and transportation has affected French metallurgy as it has no other industry but the larger companies have weathered the storm, and apart from the automobile and shipbuilding accessory industries no large slump, in either future orders or in a steady progression of output, has been heard.

During the war, and since, French economists have harped too long and loud on the iron ore resources of the new France as a panacea for all ills, and have played mute on the chord of fuel. The optimism is now shown to be unwarranted. It is this that has brought about that revision of opinion which resulted in the new school of economists known as that of "Coal and Iron Politics."

Iron ore costs France less than the same material costs either England, Belgium or Germany. For this reason France might become and should become, a formidable competitor in the export market, a role which the country actually plays only in a minor key. Fuel costs in France account for some of the difference in competitive finished product prices, greater production costs for still more, transport difficulties still more, while on the other hand the great depression in French foreign exchange is a big help to French iron and steel exporters.

French Industry Still Handicapped

Obviously as a result of the German invasion, when France was deprived of more than 60 per cent of its iron and steel resources, and during the war period when pig iron and steel production moved from the frontier departments toward the center and west of France, the industry suffered a severe handicap which only time can be expected to annul.

Since the armistice, and the reincorporation of Lorraine, the industry has

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returned to its natural region, but not without leaving a visible remainder of activity in the Normandy, Loire, Pyrenean and Bordeaux districts, where coal and coke supply conditions at the moment actually are more favorable than in the eastern districts, at least not less so, and working conditions are as favorable for export trade.

May Take Second Place

Too placid confidence has been given to the sweeping statements of the French press that France might become the world's greatest iron and steel producer. But from fourth on the list among iron and steel producing countries, France unquestionably can move up to second place, though she has not yet arrived at that point. Undeniably, however, in proportionate expansion this position has been achieved since the war. Indeed in this respect alone, the country perhaps has acquired first place.

The output of iron and steel in the invaded regions as compared with all of France was 64 per cent in the case of pig iron and 60 per cent with respect to steel. The pig iron making equipment of the invaded regions has been more than replaced by the blast furnaces of reincorporated Lorraine and others built elsewhere in France during the war period. The same is not true of bessemer converters and open-hearth furnaces, in respect to which there is today a shortage of not less than 25 per cent. These elements will have to be speedily constructed and put into operation if France is to pursue a policy of turning out profitable quantities of finished products.

Optimistically all the world has inferred that a magnificent iron and steel prosperity awaits France. Certainly her known ore resources, and even her present equipment, blandly argues for this—5,750,000,000 tons of ore in known deposits; 212 blast furnaces, 116 converters, and 164 open-hearth furnaces, including reannexed Lorraine. Of itself this argument impresses, but it does not stand alone. In addition to the points just emphasized there should be taken into consideration two other considerations which have frequently been overlooked or ignored—the shortage of coal and coke for the working up of the mineral riches of France, and further the possibility of marketing the enormous production resulting, if the mineral available could all be transformed into finished products. In pig iron alone, this would mean an increase to 10,000,000 or 12,000,000 tons per annum.

Coke Supply Should Be Doubled

Taking the item of blast furnace coke, supplies available during the first six months of 1920 did not exceed 300,00 tons per month, whereas the need of the present day French blast furnace equipment, working full, easily is double this. It is obvious that this figure should be increased to 1,000,000 tons under a really intensive production.

Of the 212 blast furnaces in France, but 95 were in operation on Aug. 1. No later figures are available, but little change has taken place since that date. It may be put down that the coke shortage accounts for the greater part of the nonoperating plants to date, though probably 50 furnaces in the Briey, Longwy and Nancy districts still are but wreckage resulting from the war. The high cost of coke certainly accounts for many furnaces being inactive.

Pig iron production in 1919 was but 2,412,149 tons, of which 55,000 tons was produced in electric furnaces. This compares with a productive capacity four times as great in 1913, including Lorraine furnaces then in German hands.

With virtually 50 per cent more equipment in the latter part of 1920, the possible French output should not be less than 10,000,000 tons per annum. But the actual figures are far short of this. The maximum pig iron production of 1920 may be estimated as not far from 3,000,000 tons with steel production at from 2,800,000 to 3,000,000 at the utmost, the latter in 1919 reached 2,150,000 tons.

Needs Have Outgrown the Supply

The needs of France in the way of fuel to double even the present production are enormous and far beyond the supplies possibly available. It is doubtful if the Lorraine furnaces last year worked at more than 40 per cent of their capacity, though producing 65 per cent of the entire French production of 1920. Definite statistics are wanting for 1920, but those just completed for 1919, and presented in an accompanying table, show the detailed production of the chief items. The figures are those of the Comité des Forges, an organization of 40 of the largest metallurgical companies of France. Taking the value of imports from the United States for the first six months of 1920 as a basis of comparison with figures for the same period of 1919, it is indicated that French independence of foreign sources of iron and steel supply is strengthening itself daily. It is inconceivable that demand or consumption is relatively any less than it has been during the past two years. These figures show that in the first six months of 1919 France imported 421,529,000 francs worth of primary iron and steel products from the United States; in the first six months of 1920 this had shrunk to 123,867,000 francs. Though imports have fallen off two-thirds from the chief source of supply it does not follow that France has supplied all the deficiency by home production. The gap undoubtedly is accounted for by a hold-off policy and the awaiting of lower prices.

Little Belgium's Splendid Recovery

BY FRANCIS MILTOUN

BELGIAN industry relatively is more prosperous than any other of the national industries of Europe. From the first sound of the trump of the armistice Belgium went to work with a will. In the realm of iron and steel the postwar achievements of this little country are specially noteworthy. Belgium has come to be recognized as the stabilizer of the iron and steel business of the continent of Europe. As in France, Belgian iron and steel prices rose to a fantastic height in the mid-months of the present year, only to drop again in the late fall to figures which are relatively lower than at any time since the war ended.

In export fields German, French and Luxemburg makers are watching the Belgian revival with great concern. Belgian iron and steel prices are even exerting a considerable influence on the British market. Belgium, aside from such current sales of iron and steel as may be made to contiguous countries, is looking forward to big trade developments with Italy, Spain, the Mediterranean countries in general, South America and the West Indies, including Mexico.

A single month's trading figures indicate the importance which exports already have attained. In July 1920, the last specific figures available, Belgium exported metallurgical products to the value of 79,000,000 francs, the equivalent of about $5,260,000 and fuel, including coke to the value of 4,000,000

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francs, or $266,000. This would give but little short of a billion francs worth of iron and steel exports in a year if the figures are sustained through the twelvemonth. Belgium's foreign trade is, therefore, already moving to the tune of $66,000,000 a year. These figures are small in comparison with Belgium's big rivals, but it should not be forgotten that two years ago they were nothing.

The average iron and steel production for the first six months of 1920 works out on the following percentage as compared with that of the first six months of 1913: pig iron, 34.2; steel bars and ingots, 42.0; and finished steel 52.4 Production for the month of September 1920 showed a steady progression: Pig iron output was 105,960 tons, or 51 per cent of September, 1913; semifinished steel, 11,234 tons, or 54 per cent; and finished steel, 96,702 tons, or 62 per cent. The general average of Belgian iron and steel production may now be put down as quite two-thirds of that which it was in 1913, and certainly 60 per cent.

Coal Production is Normal

Coal production has hovered around normal for many months. In some months it actually has been in excess of the corresponding month before the war. The year's coal production for 1920 is estimated at 22,073,712 tons, less than 1,000,000 tons below the figures for 1913. The first half of 1913 Belgium imported 5,400,000 tons of fuel but in the same period of 1920 she imported but 405,000 tons, although after the Spa agreement, in August she has been regularly receiving in the neighborhood of 200,000 tons of coal and coke a month from Germany. Out of 150,000 Belgian coal miners, 130,000 are syndicated, or unionized.

The recovery in pig iron production since the armistice as shown by the present operation of 23 blast furnaces, as compared with 54 in service before the war. Of the latter number 51 were actually out of business at the date of the armistice. When the war ended the Belgian metallurgical industry had fallen to practically nothing. On Oct. 31, 1920 the following furnaces were in operation:

Name of works	No. of furnaces	Tons per day
Sambre et Moselle	4	400
Thy-le-Chateau	1	165
Hainaut	2	250
La Providence	1	185
Chatelineau	1	150
Clabecq	1	220
Cockerills	3	464
Ougree-Marihoye	3	400
Angleur	2	300
Esperence-Longdoz	2	350
Athus	3	450

The average daily production in Belgium now stands at 3169 tons, against a prewar daily production of 6932 tons. The actual percentage today compared with before the war is 45.8 by readjusted figures. Production in 1920 will probably show 750,000 tons of pig iron and a like amount of finished steel products, the difference being accounted for by the import of other semifinished material from Germany and France.

The brightest side of Belgian industry today is to be found in the iron and steel industry. Labor troubles have been practically nonexistent, save in the coal mining industry A long working day, with its attendant overtime pay, is by no means distasteful to the Belgian workers' views. Fuel costs, although relatively less than those of France, have tended to keep iron and steel prices high, as has the wage scale, but again this latter is more favorable than in France.

Foreign orders have shown the strength of the Belgian iron and steel industry in export markets and above all others England and France have come to recognize this. However, the gait which ultimately will be struck by no means has been arrived at, nor will it materialize until stocks begin to accumulate at mills and warehouses. The tendencies are favorable toward a rapid pace after the first of the year, when it is assumed that output will be increased from 10 to 20 per cent and prices perhaps will drop 25 to 30 per cent. The latter virtually represents the relative plane on which Belgium stands today in the export market when compared with France and her depreciated franc.

New Money Poured In

New capital has been introduced into Belgian industry since the armistice on a big scale. This amounts to 29,800.000 francs in shipping; 156,325,000 francs in metallurgy; 5,000,000,-francs in the coke industry; 74,400,000 francs in coal mines; 59,538,500 francs in zinc, lead and petrol combined and 5,250,000 francs in the automobile industry.

All the larger iron and steel works, Cockerills, Ougrée, La Providence, etc., are working at full speed ahead so far as reconstructed and replaced equipment will allow, while the smaller units are making progressive efforts which in a few months it is expected will begin to show notable production results. This is particularly true of many fabricating plants and machine shops turning out rolling stock and kindred products.

A significant reaction has developed in the local consumption of structural steel since the armistice. The Belgian state railways, because of the fact that beams and girders were commanding inordinate prices, have replaced this material as far as possible by bridge and culvert construction of masonry and reinforced concrete. Abstention from purchase at ruling high prices was a notable year-end feature throughout the country and a continuance of this situation is looked for until market values approach more normal figures.

Italy Grapples with the Labor Problem

By a Special Correspondent

NOMINALLY Italy is not supposed to be a great factor in the world's iron and steel industries, but the truth is her secondary manufacturing establishments, such as shipyards, machine shops and automobile plants, are both numerous and important. Furthermore her iron and steel works are growing in magnitude. Italy probably has sufficient iron ore for many generations to come, in the island of Elba, the Val d'Aoste and the Trentin, but she always has been handicapped by dependency upon foreign coal and coke. Recently electric steel has been produced in some considerable quantities, by a subsidiary of the great Ansaldo firm, at Cogne in the High Alps, where there are deposits of iron ore closely approaching in quality that of Sweden. This effort perhaps points the way to a possible solution of Italy's fuel problem as affecting iron and steel by the intensive use of the electric furnace, the current being economically generated by water power.

Chiey Italy's record in 1920 is a story of labor troubles. The big strikes which culminated in the fall practically shut down everything for three months. The various Ansaldo plants and that of F. I. A. T., being the

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supposedly impregnable fortresses of the Italian metallurgical industry, were first to succumb to the attacks of sovietistic labor. The iron and steel industry throughout the peninsula followed suit and chaos reigned supreme for many weeks until labor without capital, and without intelligent direction, came to its debacle in late October. Reconstruction and readjustment were then called for and actually are proceeding. But until reorganization is actually brought to a sane plane acceptable to both capital and labor, a period of instability undoubtedly will continue.

Labor Is Badly Distributed

Common labor was generally paid 6 to 8 lire per day before the war; 18 to 20 lire per day during the war period; and has fallen roughly to 15 lire per day at the present time. Draftsmen, shop foremen and technicians in highly specialized metallurgical industries receive 1200 to 2400 lire per month, according to rank, capacity and classification. Italy has a sufficiently abundant, if not a surplus supply of labor, but it is badly distributed. The Italian government long after the war kept its troops mobilized fearing unemployment disturbances. Industry even now is not ready to absorb all available labor.

The Confederazione del Lavoro has adopted the 8-hour day with a 48-hour week, reduced from 55 to 60 hours per week, in the engineering and shipbuilding trades. This has been in effect in foundries since July 1, 1919. In blast furnaces and other continuously operating plants the two shifts of 12 hours each have given way to three 8-hour shifts and a tolerance of 144 hours in three weeks.

The metal industries in general practically have agreed to the adoption of the minimum wage system, but there is no universally adopted figure for this wage as yet. It may be taken for granted that 12 lire a day today represents the lowest possible living wage for all but the commonest labor. It is hoped to standardize, if possible, on 13 lire as a low base, which represents a rise from 6 to 8 lire before the war and a fall from a war wage of 20 to 23 lire. In any case, with the Italian lire at 29 to the dollar, as it is at this writing, the labor cost on any manufactured product which is to meet that produced in the United States decidedly is a minor factor.

Capital is apparently not lacking in Italy for big or moderate-sized industrial enterprises, and the order of the day is for combinations and groupings of affiliated interests, as witness the F. I. A. T.-Ilva and the Ansaldo-Sconto groups. Smaller industrial organizations in many instances have followed suit and in spite of the fact that fully three-fourths of what was reckoned as Italy's national wealth before the war, is involved in the national debt, all industry has an encouraging future if various economic and political elements can be reconciled. These elements include the possible necessity of abolishing all imports for a stated period, to imposing high tariffs on semifinished and finished products of all kinds; and of government subsidies to home industries and to such exports of the latter as may be not needed at home. Particularly are subsidies argued for the iron and steel industries. Either a subsidy or a high protective tariff it is believed will result.

With the Italian coal question of paramount importance in Italy's metallurgical industry, future progress unquestionably depends upon the adequate solution of this problem. In August approximately 100,000 tons of coal was received as compared with 250,000 tons in the preceding month. Since that time imports from Germany, England and the United States, in a way, have made up for deficiencies, but these imports are all earmarked for immediate consumption upon arrival.

The coal imports for 10 months of 1919 ran as follows:

From	Tons
Belgium	61,905
France	218,041
Germany	17,285
Great Britain	3,893,296
United States	693,305
Other	7,588
Total	4,891,410

For 1920 figures still are lacking but from Germany, according to the Spa agreement, a small quota, which probably accounts for 250,000 tons, has come through. The 1919 figures for the United States may be trebled if the yearly autumn deliveries are kept up to the end of the present year. France in return for the supplying of Italian miners, has agreed to ship 6 tons of coal per man, per month, to Italy, and even Belgium is passing along some of her quota. But Italy's need is for double the 1919 figure of coal imports if industry, railways, gas works and shipping are to carry on adequately.

Italy's Iron and Steel Output

Of mines, the Italian census gives the following as of January, 1919: Iron ore, 28 exploitations producing 942,244 tons, with 2329 workers; lignite, schiste and fossil coal, 223 exploitations producing 2,216,583 tons with 9705 workers; and peat, three exploitations producing 69,552 tons with 1225 workers. The progressive extraction of lignite is eloquent in showing the effort Italy is making to solve the fuel problem. From 543,137 tons in 1907 the production has increased to 2,216,583 tons in 1918, the number of exploitations having grown from 39 to 223 during the period.

In January, 1920, there were 49 Italian establishments engaged in first-hand production of iron and steel. Pig iron was produced in 10 coke blast furnaces to the annual amount of 450,000 tons; and seven electric furnaces producing 16,911 tons per annum. These furnaces employed 3079 workers. Steel was produced in 37 plants, amounting to 1,269,486 tons, with 8811 workers. Coke was produced in 19 ovens.

Increased Production Doubtful

It is doubtful if these figures will be exceeded in 1921 owing to labor troubles, transportation difficulties and the coal shortage.

Current market prices in the early autumn ran as follows with little likelihood of an immediate drop until Italian foreign exchange, now at 29 to 30 lire to the dollar, should improve and home production increase: Soft coal stood at 750 lire per metric ton; pig iron at 1350 lire; scrap iron and steel at 600 lire; steel bars at 2250 lire; billets at 1600 lire; plates at 2500 lire; and beams at 2150 lire.

Pig iron imports in 1919 were valued at 133,103,232 lire; steel ingot imports provisionally, 5,698,224 lire; iron and steel wire, 11,469,600 lire, and scrap iron and steel, 196,236,672 lire. The obvious deductions from these figures are that so far as possible the Italian industry was making its own plates, sheets and castings as far as possible.

During the early part of 1920 Italy discouraged trade with the United States, particularly in the matter of purchases. The administration, probably because it was under the influence of skillful intermediaries, with their exports in commerce so varied and of such great proportions, they did not see the danger and damage of supplying exclusively to countries where selling organizations were formidly constituted, reaching almost a monopoly of the products. Thus Italy saw no other seller than the United States and from that market, the greatest part on credit, obtained enormous quantities of goods of all sorts. It was natural, therefore. that the exchange of the Italian lira with the American dollar should reach hypothetical heights.

A large part of the natural products necessary to Italy, particularly those which constitute the greatest part of her imports could be obtained from countries nearer at home.

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Germany Trying To Settle Down

Tremendous Problems Face Iron and Steel Industry in Former Teutonic Empire—Production Slowly Creeping Up—Reaching Out for Export Markets—Radical Labor Legislation Is Obstacle

BY A SPECIAL CORRESPONDENT

Connected in a High Official Capacity with the German Iron and Steel Industry

THE German iron and steel industry now is in a position to take stock of its first year under peace conditions. In the year 1918 it still was full of energy, and in output and capacity surpassed only by the United States. The tragedy of 1919 deprived it of its most important raw materials, so that torn by internal strife and violently shaken by grave disorders, the German iron and steel industry entered upon the first year of peace with but a shadowy semblance only of its former imposing structure, hardly capable of performing its vital functions. A new era in its history has commenced.

With Germany's ratification of the treaty of Versailles the iron and steel industry struck off its bonds forever more than 40 per cent of its blast-furnaces, more than 45 per cent of its steelmaking plants and nearly 35 per cent of its rolling mill establishments. Furthermore important smelting works were situated in Lorraine and were, as late as during the war, enlarged and extended on the most modern lines. By the occupation of the left bank of the Rhine and Upper Silesia two further large industrial districts were withdrawn from a uniform policy of supervision by the iron trade. Above all, the uncertainty regarding the future of Upper Silesia, the second largest iron and coal district, is giving rise to grave anxieties. Upper Silesia supplies the East of Germany, namely the provinces of Silesia, Brandenburg, Pommerania, East and West Prussia, and Berlin with iron and coal. Its works moreover export to Poland, Czecho-Slovakia, Sweden, and Lithuania, and thus produce exchange values for foodstuffs and raw materials of which Germany stands in urgent and pressing need.

No Poles Need Apply

From the German viewpoint an Upper Silesia under Polish sovereignty is unthinkable. Its iron industry was created and built up from its first primitive beginnings at the time of Frederick the Great solely and exclusively by Germans. Among its leaders, chiefs, and higher officials there is not one single Pole to be found; of its clerks, foremen and workmen 80 per cent are German. Should, contrary to all expectations, the plebiscite in Upper Silesia favor Poland, an almost complete collapse of Germany's entire economic structure and, antecedent to this, a smashup of the western iron and steel industry would be inevitable. The collieries remaining to Germany after that would not suffice to supply the eastern part of the country and Berlin and at the same time feed the large industrial works. The uncertainty resulting from this contingency throws a shadow of depression over the German iron and steel market.

In 1919 the government ministers Wissell and Möllendorf conceived the idea of a co-ordinated government controlled industrial system for the whole of Germany known as the *Plantwirtschaft*. At the commencement of 1920 this system was introduced by the iron and steel consuming industries and, with the assistance of the government was forced upon the iron and steel producing industries. The *Stahlwerksverbrand*, the old German sales organization could not be entrusted with these tasks, as one after another of its members seceded from it. After repeated compulsory attempts by the government to prolong its life it was finally dissolved on July 1. A government decree on April 1 transferred the duty of meeting the most urgent home demands, of fixing prices and conditions of sales, and of regulating imports and exports to the *Eisenwirtschaftsbund*, a compulsory all-German syndicate for heavy iron and steel products. Within the scope of its operations fall pig iron, ferromanganese, ferrosilicon, and scrap, and in addition, semifinished steel, shapes, bars, railway fittings, wire, plates, wrought-iron tubes, railway wheel-sets, and axles. The specified terms of delivery and sale are settled by a vote, which must be approved by the government. On several occasions the latter has quashed the decisions of the syndicate and compulsorily reduced prices in opposition to it. For meeting the home demand special supply syndicates are being established. Nonfulfilment of these syndicates' conditions is punishable by heavy fines and imprisonment.

Organization Is Overdone

It stands to reason that a cumbersome administrative apparatus of this type will naturally exercise an extremely restrictive influence upon the activities of the iron and steel industry. Neither the producers, the merchants, nor the consumers have had any cause to be pleased with the creation of the *Eisenwirtschaftsbund*, as it has been unable either to raise production or meet the home demand. Nevertheless, a dissolution of the syndicate cannot be counted upon for the immediate future.

The foreign exchange fluctuations have forced Germany to control not only her home industry but her export trade as well. The regulation of exports and imports is in the hands of the export trade service of the *Eisenwirtschaftsbund*. To protect the domestic market against excessive exports and to make sure that world market prices are secured for export sales, the export trade service subjects even the smallest sales to close scrutiny. Consent is given when for every country and every product the prescribed minimum prices have been reached. Moreover, for purposes of favoring the home demand, only a small percentage of the production is granted an export certificate. A similar state of affairs exists with regard to the importing of iron and steel, which is equally dependent upon the issue of licenses. Vehemently as this compulsory regulation of imports and exports has been assailed from all quarters, yet in view of the violent fluctuations of German exchange, the conviction is gaining more and more ground that the time for a release of the export and import restrictions has not yet arrived.

To complete the picture of the conditions under which the German iron and steel industry is working at present, the most important social questions confronting the past year and the

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immediate future must be considered.

Under pressure of the masses in the street a law was enacted by parliament in January establishing *Betriebsträte*, or workers' control boards, for all industries. By virtue of these boards the workers and employes are, among other provisions to be given an insight into, the commercial and technical management as well as a seat and vote in the board of directors of all industrial or trading concerns. It is impossible as yet to gage the effect of this law, as only very few of the workers or employes are competent to make full use of the power ceded to them by the law.

Schools and high schools have been opened, however, for the specific benefit of the workers' control boards in which the workers are given ample opportunity of acquiring expert knowledge of all commercial, technical and political-economic questions affecting the working classes. During the past year the activities of the workers' control boards were in the main directed more toward destructive than constructive efforts. Principally in Upper Silesia, but in part also on the Rhine and in Westphalia, they have distinguished themselves by terrorism of the worst type, dismissal of leading officials, and arbitrary and unwarrantable closing down of establishments. Thus far the leaders of industry and commerce are justified in regarding these boards as institutions bent upon systematically carrying politics and strife into industrial life.

Demand Nationalization of Mines

While the nationalization of the iron and steel industry is advocated only by a few radical elements, the entire bulk of the socialistic working classes shows a solid phalanx in its demand for the nationalization of the coal mines, all warnings and exhortations notwithstanding. But the German coal mining and iron and steel producing industries are so intimately bound up with each other, and their vital interest so closely intertwined that necessarily they will stand or fall, live or die together.

The nationalization commission appointed by the government during the autumn of 1920 has submitted for consideration two proposals. While the one aims at a complete and immediate transfer of all coal mining properties and all production and sale of coal to the commonwealth without any compensation or reimbursement to the mine owners, the second plan, conceived by Walter Rathenau, president of the German General Electric Company, advocates a full nationalization only after 30 years. According to his project the collective management of the production and trade in coal is to be placed into the hands of a board of directors; the individual collieries are to retain their independence but must deliver their coal at cost.

Counter Proposal is Offered

On the part of the employes, Hugo Stinnes, the well known mine owner and captain of industry, has come forth with a counter proposal. In conformity with his conception of nationalization, private enterprise is to be left unhampered and untouched, but, by means of central supply organizations for entire branches of industrial activity, gas, electricity and household fuel is to be furnished to the communities at the lowest possible prices. The final settlements on the question of nationalization, which perhaps may be expected shortly, also will decide the future of the iron and steel industry.

For the whole year of 1920 there was a chronic shortage of raw material especially coal. In spite of the most energetic efforts it has been impossible to increase the coal production sufficiently for an improved supply for industry, railways, gas and electric works. Various attempts to increase the working hours met with the most determined resistance on the part of the miners.

After prolonged, tedious deliberations, however, the miners announced their willingness, first at the end of February, then in July, and lastly in November, to conclude a special agreement according to which they will put in an extra half shift twice a week against a 100 per cent overtime pay and an essential improvement in the supply of bread and fat. As a result of this agreement the production of coal increased from 10,328,647 tons in January to 11,549,516 tons in September, and of coke from 1,925,295 tons to 2,210,329 tons. Several establishments have introduced American coal for the maintenance of their works. To the shipbuilding yards and the thin sheet mills 2000 marks and more per ton.

The immediate consequence of the shortage of coal was the change-over of the iron and steel industry from coal to lignite and briquettes, which was greatly assisted by a broadly conceived and well organized system of improvement in thermodynamics, for the study of which a special institute was established at Dusseldorf and endowed with liberal funds.

The state of the home iron ore market was unfavorably affected throughout the year by the continued lack of coal. This was particularly noticeable during the spring when the supply to the mines was so poor that in the Siegerland and Dill districts works had to close down completely for several weeks. But finally in the Siegerland and Lahn districts the ore output rose from 40 per cent to over 70 per cent of the prewar capacity. About the middle of the year the supply of native ores to the smelting works showed an appreciable improvement.

The supply of Swedish ores encountered two great obstacles, lack of cargo space and a strike lasting many weeks at the Groengersberg mines. The freights from Lulea to German North Sea ports fell from 225 marks to 140 marks a ton during the year. The supply of Spanish ores also was retarded temporarily by the transportation workers strike in Holland, but later improved. As the supplies of Lorraine ore are in the hands of the French government, German iron industry will have to still further extend its purchases of foreign ores including those of Spain and South America for the ensuing year. Also owing to the poor supply of fuel the works will be compelled to use high grade ores on a larger scale, since they are more easily reducible than the German ores. Prices of native Siegerland ore increased from 129.10 marks in January to 271.10 marks a ton in December; native Spathic ore advanced from 193.40 to 406.50 marks; and minette ore from 23.50 to 26 French francs a ton.

In the case of scrap peculiar symptoms were observable. At the beginning of the year every consumer tried to secure quantities of scrap iron far in excess of actual requirements. The steel works made their deliveries of finished product dependent upon the receipt of adequate supplies of scrap. Without any apparent cause a heavy reaction set in in June, and prices fell over 50 per cent within a short time.

Labor on a Rampage

The longed-for peace with labor did not materialize during the past year. In January the labor troubles of the year were inaugurated by a lawless strike of the railway men which threatened to paralyze the whole industrial life of the country. Then in the middle of March followed the terrible disturbance of the Kapp revolt which shook the entire economic structure of Germany to its very foundation for a period of several weeks. The iron and steel works lay idle, and even emergency operations scarcely were performed. On the Rhine, in Westphalia, and Saxony a red army 50,000 strong was collected and, armed with guns and *flammenwerfer*, proceeded to set ablaze the rest of civil war.

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Partly by force of arms and partly by skillful parleying these forces were disarmed and coaxed to return to peaceful labor again.

Laborers Become Peaceful

Even though later many violent suspensions of works by lawless strikes took place, and outrages were committed on managers and directors, generally speaking industry and diligence began to return in an increasing measure. Piecework was reintroduced in May and soon after one was led to believe that the upward movement of wages had at last come to a standstill. On the Rhine and in Westphalia a collier at this time was earning 63 marks per shift as against a prewar wage in July, 1914 of 6.60 marks. In August consequent upon the enactment of the law deducting 10 per cent off the wages for income, new troubles arose, but since then a return to reason appears to be noticeable among larger sections of the laboring classes.

Extremely limited in supplies of raw material and repeatedly interrupted and obstructed by revolts, strikes, and violence, the output of the German iron and steel industry in 1920 was disappointing. After a promising start at the beginning of the year one blast furnace and one steel works after another had to be closed down because of the coal shortage. Of the 200 blast furnaces, approximately, which remain in the possession of the German industry, barely 100 were at work at the end of the year.

On the basis of these conditions the output for the year 1920 may be roughly estimated as follows: Pig iron, 7,000,000 tons; steel ingots, 8,000,000 tons; and rolled steel, 7,000,000 tons. By comparison, the output for 1919 was: Pig iron, 6,192,000 tons; steel ingots, 7,644,000 tons; and rolled steel, 6,250,000 tons, and for 1913, the output of pig iron was 19,300,000 tons and of steel ingots 18,960,000 tons.

In conformity with the stiffening of the foreign bills of exchange during spring and fall of the year the German foreign trade showed an unexpected briskness. The oversupply of the home market in September permitted of raising considerably the limited export quota for many products. The government has signified its intention to allow even further quantities to be exported, profits are utilized for lowering home prices.

Selling Again in South America

Holland, Scandinavia, and Switzerland, with the late addition of South America, have become the principal export areas for the German iron and steel industry. Scarcely any orders, however, are procurable from England, France, and Belgium. Viewed on broad lines, foreign competition was seriously felt only during the summer, when the English and Belgium industries were in a position to underbid prices in the German export areas up to 30 per cent.

The exported quantities however must be increased tremendously, to at least double the present figure, if Germany is to pay for her imports, stabilize her exchange, and pay off her debts.

The milliard burdens imposed upon Germany demand strictest economy and thrift and the highest possible efficiency at all works. A tendency in this direction is observable in a movement which appears to inaugurate an era of amalgamations and fusions on the largest scale. With the object of securing their raw material supplies, finishing mills, shipyards, engineering works, etc., are striving for a closer connection with smelting works, while the latter endeavor by means of mutual combines and an absorption of mining properties to place their requirements of coal and ores on a broader basis. Combinations have been numerous during the period under review, but far above the rest towers the mighty Stinnes enterprise. After the Deutsch-Luxemburgische Bergswerksgesellschaft in the summer concluded a common working agreement for a period of 80 years with the Gelsenkirchner Bergwerks A. G. under the title of Rhein-Elbe-Union, the Bochumer Gussstahlwerke and the Gebr. Göhler Stahlwerke later joined this combination. Another common working agreement for a period of 80 years has now been arranged by the Stinnes interests with the second largest electrical engineering works in Germany, the Siemens-Schuckert Gesellschaft. While full operating and corporate independence has been reserved to all the members of this trust, the latter are to operate and co-operate on distinctly uniform lines to enable them to supply their refining works with raw material, from coal to ore and steel, as cheaply as possible. In spite of all the destructive elements showing in the political, economic, and social conditions in Germany, it is believed an amalgamation such as this—from iron ore to incandescent lamps—will place German industry in a position to appear as a competitor in the world's market and expand its exports on a broad and far reaching basis.

A Troubled Year in Central Europe

BY BRUNO SCHAPIRA
Czech and Austrian Correspondent of The Iron Trade Review

THE year 1920; like both its predecessors was marked in Central Europe by the general economical difficulty and distress, caused by the tremendous shortage of coal and raw materials, and the continuous low rate of exchange. In Austria the under-feeding general among the working populace, the introduction of the 8-hour working day, and other measures of a social character, have resulted in a continuous decrease in the average output per man which could not be entirely made up by employing of greater numbers. In spite of slow business, the factories, in Austria are bound by law not to dismiss their laborers, in order to avoid increasing the number of unemployed. In the year 1913 the average daily output of an Austrian coal miner amounted to 2 1-5 tons whereas in 1920 it is only a little more than 1½ tons. During the last six months partly successful efforts have been made to increase the output of the miners by granting food premiums.

Coal Supply Inadequate

Even postwar Austria possesses steel works with a productive capacity far exceeding the home demand, but owing to the inadequate supply of coal, these works are occupied at only 25 to 30 per cent of capacity. The monthly requirements of coal and coke amount to 1,150,000 tons but only 555,000 tons per month are being supplied. At any rate, this represents a little improvement as compared with the year 1919, when the monthly supply amounted to only 400,000 tons. This small increase in coal supplies has been rendered possible, first by an increased inland output of coal, and second, by a treaty concluded between Austria and Czecho-Slovakia. By this treaty Austria is bound to deliver 100,000 tons of raw iron ore and 70,000 tons of roasted ore yearly to Czecho-Slovakian as well as 5400 tons of pig iron per month, for which Austria is in return supplied with 10,000 tons of coke a month. Thus Austria was enabled to keep at least one of the six coke blast furnaces of the Alpine Montan company in blast.

The Austrian output of iron ore amounted, in the first five months of

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1920, to 100,000 tons, or hardly one-tenth of the output of the year 1916. Since that time, the ore output has been somewhat increased especially for the purpose of complying with the treaty with Czecho-Slovakia. In the same period the production of pig iron amounted only to 25,000 tons, or hardly 6 per cent of the production in 1916. Of steel, about 100 tons were produced daily during this period, this being about 13 per cent of the 1916 output. Supplies of coke have improved since the summer of 1920, apart from some interruptions, so that it has been possible to increase the daily output to 300 tons of pig iron, compared with 1900 tons in prewar time, and 650 tons of steel. The comparatively high steel production has been rendered possible by melting large quantities of scrap released by the destruction of war material.

Limited Quantities Exported

At the outset of the year, the demand on the iron market was of a feverish nature, every bit of iron being literally torn from the hands of the producers, due largely to the fact that deliveries from Czecho-Slovakia and Germany were very difficult to obtain and home production impoverished. Production is still far behind the demand nevertheless limited quantities have been exported both to Italy and Jugoslavia. This is due first, to provide foreign currency, and secondly owing to the fact that an Italian group headed by the Fiat works has made itself proprietor of the majority of the Alpine Mining company's shares. In the middle of February Austrian prices were increased, the basic price for 100 kilograms on 220 pounds steel bars, at the works being fixed at 1150 crowns. In the month of March production had increased, and the exchange value of the Austrian crown rose temporarily, so that coke from Czecho-Slovakia was cheaper and on April prices were lowered. Steel bars were reduced to 850 crowns per 100 kilograms, plates to 850 crowns and semifinished steel to 600 crowns. This reduction was of short duration. The exchange value of the crown fell again and this in turn led to an increase in the price of iron and steel. Accordingly in the month of May the base prices for steel bars again were advanced to 1090 crowns with corresponding increases in the prices of the other kinds of iron products.

The general decrease in business activities which has spread over Europe since the midyear has had its reaction on Austrian conditions, in that the producers have become willing to make deliveries, and both Czechian and German iron more easily is obtainable. There can however be no question of a slump in prices in Austria, as long as the exchange of the crown is on the decrease. In November, in fact, prices once more had to be raised. Steel bars advancing from 1100 to 1200 crowns per 100 kilograms. But if these prices are calculated in dollars at the rate of exchange at the end of November, they will be seen to have undergone a material reduction.

Whereas Austria offers the lamentable sight of a state unable to emerge from economic distress by its own power, always awaiting and courting foreign help—a state of things which is sadly reflected in the excessively low production figures of its iron and steel industry—Czecho-Slovakia shows many signs of economic recovery, and her iron and steel production is rapidly nearing normal conditions. Czechia, it is true, possesses only a small ore supply, and has in a high degree to resort to the importation of foreign ores. But she has been left with the biggest iron works of the former monarchy, and the greatest part of the coal mines of prewar Austria.

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Aug.	1260	3600	11,700	0.019	0.005
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Oct.	1200	3250	11,900	0.014	0.003
Nov.	1200	3000	12,000	0.017	0.002
Dec.	....	....	....	....	....

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The Czech ore output, which in 1913 amounted to 2,500,000 tons, shrunk in 1920 to hardly 1,000,000 tons; moreover the ores possess such a high percentage of phosphorus that they can be used in only a limited way. The Czech blast furnaces, when smelting 7600 tons of home ores produce 3100 tons of pig iron, whereas from 6700 tons of foreign ores they obtain 3400 tons of pig iron. Moreover the consumption of coke in the first case amounts to 1462 kilograms, (3216 pounds) and in the latter case, to only 869 kilograms (1912 pounds) for each metric ton of pig iron produced. In order to alleviate the shortage in iron ores, compensating conventions have been concluded with Austria, France, and Sweden, and as an experiment, pig iron also has been imported from Luxembourg. Through the incorporation of the duchy of Teschen into the Czecho-Slovakian state, the situation has been much relieved. Czecho-Slovakia thereby obtained possession of new iron and steel works with a total annual output of 480,000 tons of steel (the production, in peace times, of the Prague and Witkowitz iron works amounting to 900,000 tons of steel), together with rich coal mines and extensive coking plants. The entrance of the new works will considerably sharpen competition on the home market, and this is bound to result sooner or later in a material fall in prices, as production conditions have considerably improved since last autumn.

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During the first quarter of 1920, the Czech plants owing to difficulties in the provision of coke worked only at 40 per cent of their full capacity. The home demand was so great there was little thought of exporting. Owing to the reduced output combined with the heavy demand, all plants were choked with orders, and deliveries were far extended. In the month of January, the Czech works considerably increased their prices, pig iron advancing from 720 to 1000 crowns, steel bars from 1450 to 1950 and plates from 1550 to 2300 Czech crowns per ton. Late in February a new advance in prices was deemed necessary, pig iron rising to 1240 crowns, bars to 2500 crowns, hoops to 2800 crowns, and plates to from 2900 to 3200 crowns per ton.

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Toward the middle of the year 1920, the general relapse of the European business structure was reflected in the Czechian industry and the demand slowed up. The government was enabled to recall its embargo on iron and steel, and to allow 20 per cent of the output of the plants to be exported. In order to speed up business in the engineering industries in the fall of 1920 a reduction in price of 50 crowns per 100 kilograms for steel used for export purposes was granted by the producers, and 30 per cent of the output of the works was released by the government for export, a figure which is to be still further increased.

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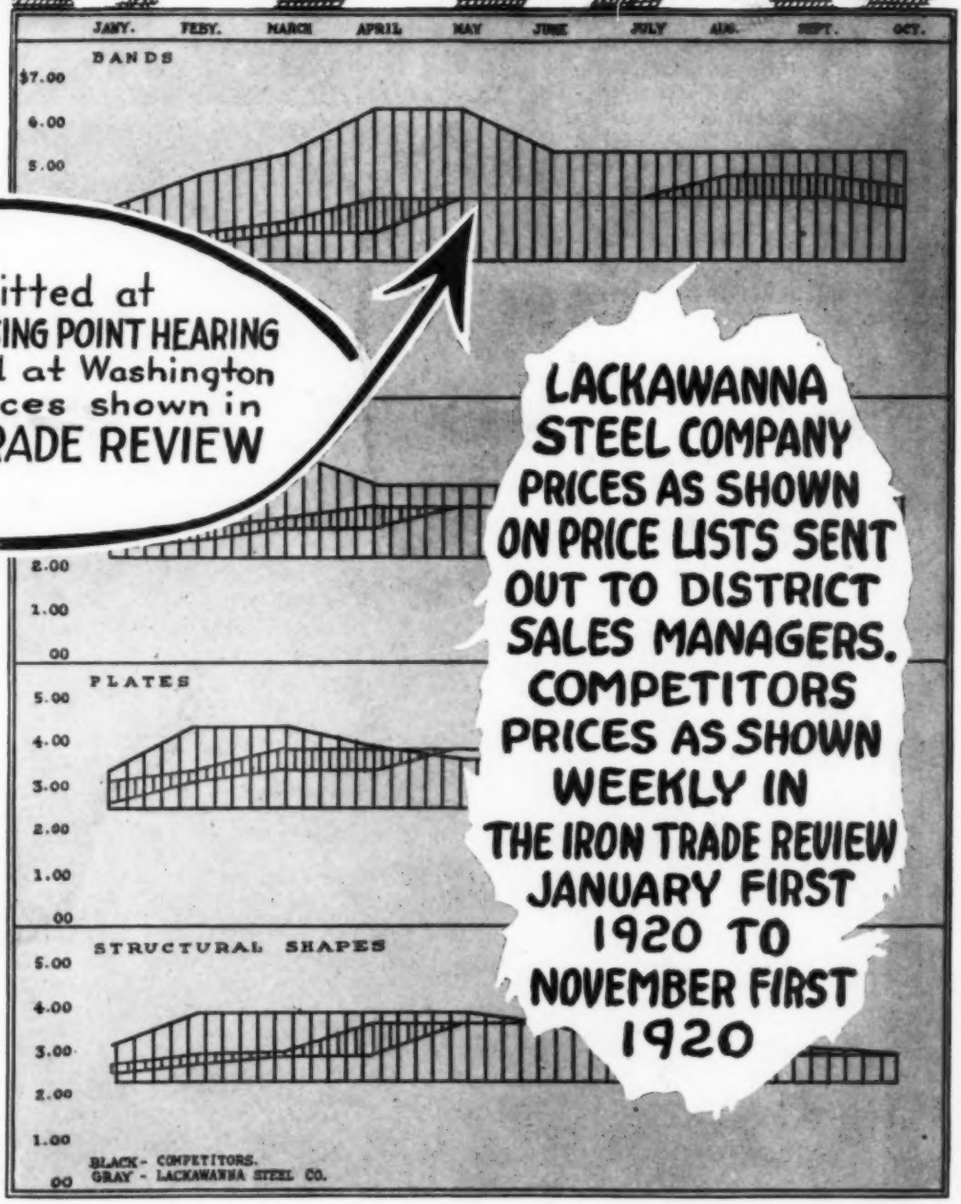

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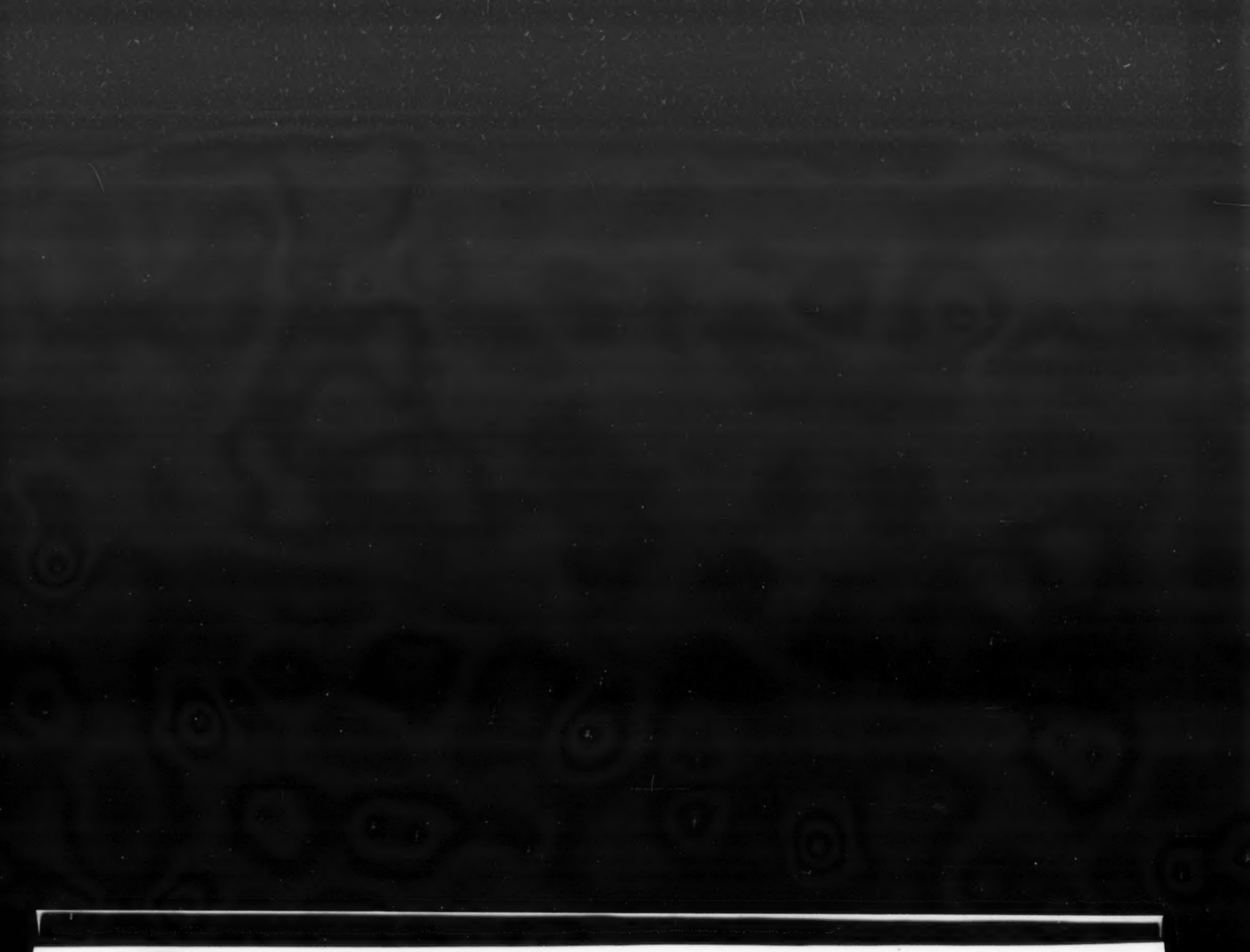

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